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(71) Applicant:
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
Kadoma-shi, Osaka 571-8501 (JP)

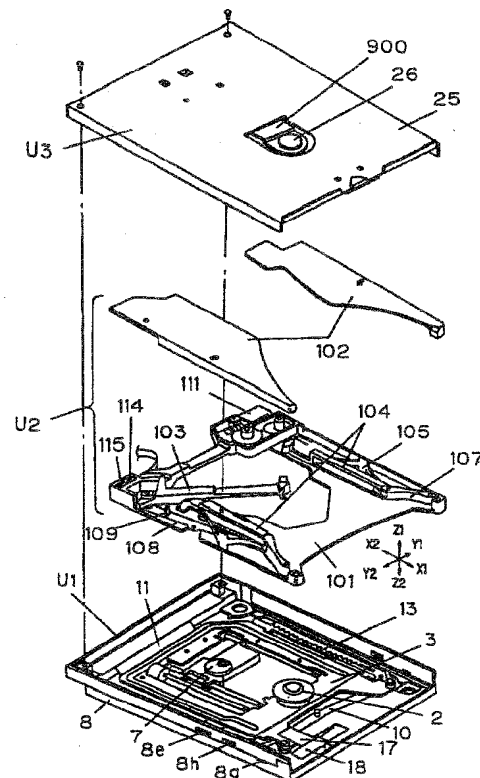
(72) Inventors:
• KUROZUKA, Akira
Fujiidera-shi, Osaka 583-0033 (JP)

- HANAKAWA, Eiichi
Soraku-gun, Kyoto 619-0223 (JP)
- MAEDA, Shinichi
Higashiosaka-shi, Osaka 578-0901 (JP)
- EZAWA, Kohzoh
Katano-shi, Osaka 576-0054 (JP)

(74) Representative:
Kügele, Bernhard et al
NOVAPAT INTERNATIONAL SA,
9, Rue du Valais
1202 Genève (CH)

(54) DISC LOADING APPARATUS AND ADAPTER FOR DISCS

(57) A disk loading device according to the present invention includes: a holder for detachably retaining a cartridge; transfer means for transferring the holder; shutter opening/closing means for opening a shutter of the cartridge when the cartridge is inserted into the holder; and rotation driving means having a retention section for retaining a disk in the vicinity of a center thereof, the disk being within the cartridge having been transferred to a predetermined position by the transfer means, wherein the rotation driving means rotates the disk retained by the retention section. During transfer by the transfer means, an opening of the cartridge previously closed by the shutter of the cartridge passes where the retention section of the rotation driving means is located with the shutter of the cartridge being opened by the shutter opening/closing means.



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Description

TECHNICAL FIELD

[0001] The present invention relates to a disk loading device for moving an optical disk in/out of a recording/reproduction apparatus for recording or reproducing information on the optical disk.

BACKGROUND ART

[0002] Recording/reproduction apparatuses for optical disks are widely used for audio disks, video disks, and as data storage apparatuses for computers.

[0003] Optical disks include those accommodated within cartridges which are capable of recording/reproduction and primarily used for data storage purposes, and those used in a bare form which are capable of reproduction only, e.g., music CDs and CD-ROMs. Advances in the multimedia technology have enabled simultaneous progress in the digitalization of AV apparatuses and enhancement of AV functions of computers. In the case of optical disks, too, disks are desired which are widely applicable to recording/reproduction of various information, without distinction between AV apparatuses and computers.

[0004] Furthermore, the miniaturization of not only AV apparatuses but also personal computers has led to the need for thinner recording/reproduction apparatuses for optical disks.

[0005] In other words, optical disk recording/reproduction apparatuses are strongly desired which are thin and which are compatible with various forms of media.

[0006] However, since disks accommodated within cartridges and bare disks require different loading methods, it has conventionally been necessary to use a disk loading device dedicated to cartridges and a loading device dedicated to bare disks.

(Conventional Example 1)

[0007] First, a loading mechanism for cartridges having an internal optical disk, which is mainly used as a data storage device, will be described with reference to the figures.

[0008] In general, after a cartridge is inserted in an optical disk apparatus having this type of loading mechanism, it is necessary to move the cartridge toward a spindle motor and an optical pickup, and mount the disk on a turntable so as to enter a state for enabling recording or reproduction.

[0009] Figure 41 is a perspective view showing the structure of the disk loading mechanism according to Conventional Example 1. Figures 42A and 423 are side views illustrating the operation thereof. Figure 43 is a schematic view showing relative dimensions in the device along a thickness direction.

[0010] Referring to Figures 41, 42A, and 42B, the car-

tridge 201 is inserted into a cartridge holder 202 at the front face of the device. At this time, a shutter 201a of the cartridge 201 engages with a shutter opener 210 incorporated in the cartridge holder 202 so as to slide and expose a portion of the disk within the cartridge 201. Provided on both sides of the cartridge holder 202 are four guide rollers 203, which are inserted in guide grooves 205 provided on both sides of a slider 204. Each guide roller 203 is mounted so as to be movable by only a dimension d along the vertical direction, along a guide pole 207 provided on a chassis 206.

[0011] The slider 204 is mounted so as to be capable of sliding by only a dimension s along the direction of arrow A, along a guide pin 208 provided on the chassis 206, in a manner to interpose the cartridge holder 202 from below. The slider 204 is always energized by a slider spring 209 in the A direction with respect to the chassis 206. In an initial state, the slider 204 is held by a lock arm (not shown) so that the slider spring 209 remains in its most extended state (see Figure 42A).

[0012] A clumper 214, which is pivotably supported by a support arm 215, is disposed in an opening 202a in the center of the upper face of the cartridge holder 202, so as to oppose a turntable 212 connected to an axis of a motor 211. The clumper 214 and the turntable 212 are attracted to each other owing to the attraction force between a magnet and a piece of magnetic material provided within the damper 214 and the turntable 212.

[0013] Owing to the action of a cam (not shown) provided in a slider 204, the support arm 215 pivots in accordance with the position of the cam, so as to move the clumper 214 up or down. In an initial state, the clumper 214 is raised to a position where it does not interfere with the inserted cartridge 201 (see Figure 42A).

[0014] With the insertion of the cartridge 201, the lock arm is released as it is pressed by one corner of the cartridge. When the lock arm is released, the slider 204 slides along the A direction owing to the action of the slider spring 209; the guide rollers 203 move along the guide grooves 205; and the cartridge holder 202 moves by a dimension d in the direction of the chassis 206 (arrow B). At the same time, the support arm 215 pivots by the action of the slider 204, and the damper 214 moves in the direction of the turntable 212. As the cartridge is moved down, the disk within the cartridge 201 goes on the turntable 212, and the clumper 214 is attracted onto the disk from above so that as to mount the disk in a rotatable manner, and the disk approaches an optical pickup 213 down to a distance for enabling recording/reproduction (see Figure 42B).

[0015] When the cartridge is to be taken out of the apparatus, the slider 204 is pulled back by a loading motor 216 against the tensile tension of the slider spring 209, so that the clumper 214 and the cartridge holder 202 are moved up to their positions in the initial state. As a result, the disk is detached from the turntable, rendering the cartridge ready to be taken out.

[0016] As shown in Figure 43, when the cartridge 201

is to be inserted, a distance (dimension **D**) exceeding the thickness of the cartridge **201** is required between the turntable **212** and the clasper **214**.

(Conventional Example 2)

[0017] Next, a loading mechanism for an optical disk apparatus for bare disks such as music CDs and CD-ROMs will be described with reference to the figures.

[0018] Conventional Example 2 are shown in Figure 44 and Figures 45A, B, and C.

[0019] Reference **53** denotes a main chassis. Attached to the main chassis **53** are: a disk motor **56**; a turntable **58** which is mounted to an axis thereof; a center cone **58a** on the turntable **58** which engages with a center hole **45a** of a disk **45** as a recording disk; a head **43** which is placed by a guide shaft **55** so as to be slidable along the **Y1-Y2** direction, and which has a coil **43a** for a linear motor mounted thereon; and a magnetic yoke **54** for the linear motor. At one end **53a** of the main chassis **53**, a hole **53b** for pivotal support is provided, and a pivotal axle **51** passes through the hole **53b**.

[0020] Similarly, at one end **47a** of a clamp lever **47** is provided a hole **47b** for pivotal support, and the pivotal axle **51** also passes through the hole **47b**. The pivotal axle **51** is affixed to a projection **52** within a housing **42**.

[0021] A tray **41** is mounted within the housing **42** so that it is capable of translation along the **Y1-Y2** direction owing to engagement motion between a rack **41a** formed on its back face and an output gear of a loading motor **57** which has a gear unit for deceleration mounted thereon. Moreover, the tray **41** has a dish-like concavity **46** capable of retaining the disk **45** placed therein. A small-diameter concavity is formed inside the concavity **46** to allow a small-diameter disk **60** to be placed in the small-diameter concavity.

[0022] Furthermore, a cam **50** is engaged to the rears of the main chassis **53** and the clamp lever **47**, the cam **50** being driven by a geared motor **49**. The main chassis **53** and the clamp lever **47** pivot around the pivotal axle **51** so as to move closer to or away from each other in accordance with the rotational position of the cam **50**. Reference numeral **44** denotes an insertion inlet; **41b** denotes an opening; and **48** denotes a damper. The operation of the loading motor **57** and the geared motor **49** are subjected to ordinary microcomputer control or the like. The detection of the positions of the cam **50** and the tray **41**, which are driven by the respective motors, is accomplished by an ordinary microswitch or the like. Such details are not shown in the figures, and the descriptions thereof are omitted.

[0023] Figures 45A, B, and C describe an operation of this conventional disk loading device. Specifically, in the case of using the disk **45** in a disk recording/reproduction apparatus, when an eject/load switch (not shown) is pressed, the tray **41** is moved in the **Y2** direction by the driving force from the loading motor **57**, and goes out of the housing **42** so as to enter the state shown in Figure

45A, through microcomputer control. At this time, the clamp lever **47** and the main chassis **53** are in moved-away positions from each other around the pivotal axle **51**.

[0024] In this state, by placing the disk **45** in the concavity **46** of the tray **41** and pressing the eject/load switch (not shown), the tray **41** is translated into the housing **42** through the insertion inlet **44** owing to the driving force of the loading motor **57** to enter the state shown in Figure 45B.

[0025] Next, the cam **50** rotates so that the clamp lever **47** and the main chassis **53** move closer to each other around the pivotal axle **51** as shown in Figure 45C, and the disk **45** is sandwiched between the damper **48** and the turntable **58** of the disk motor **56** so as to engage with the center cone **58a**, thus becoming rotatable. In this state, the recording or reproduction of information from the disk **45** is performed by the head.

[0026] When the disk **45** is to be taken out of the apparatus, the exact opposite operation to the above operation is performed.

[0027] However, the aforementioned conventional disk loading devices for disks have the following problems.

[0028] In accordance with Conventional Example 1, after the cartridge is once horizontally inserted, the cartridge is moved down in the direction of the spindle motor so as to place the disk on the turntable **212** into a state for enabling recording/reproduction by the optical pickup. Therefore, with respect to the space which is left after the cartridge has moved down, a redundant space is created which has a thickness defined by dimension **D** as shown in Figure 43. Furthermore, it is necessary to retract the clamp **214** to above the cartridge, thereby hindering reduction in the thickness of the device.

[0029] On the other hand, it is impossible to directly load a bare disk, such as a music CD and an information CD-ROM, and it is necessary to place the bare disk into a cartridge, called a "caddie", before the cartridge can be loaded. In this case, the caddie must be taken out of the disk loading device every time a disk is exchanged, resulting in complicated operations.

[0030] Moreover, due to the nature of cartridge specifications, the positions and sizes of positioning holes in the cartridge may be commonly shared between disk loading devices, but some cartridges may have differently dimensioned shutter front ends due to differences in the shutter structure of each cartridge. When such a cartridge is inserted, even though the cartridge may be inserted and mounted in the holder **202**, the shutter opener **210** will not pivot to the final end of the pivoting path. In such a state, there is a problem in that the shutter opener **210** is susceptible to vibration, and, at impact, the shutter opener **210** may be disengaged from the shutter so that the shutter may be closed within the device.

[0031] In accordance with Conventional Example 2, any disks that are accommodated within cartridges can-

not be used. Moreover, since the loading motor 57 is disposed under the tray 41, the thickness of the overall device cannot be reduced by reducing the thickness of the optical head or the disk motor. The device cannot be used in the upright position by merely placing a bare disk on the tray.

[0032] If large diameter and small diameter concavities are formed so as to define two stages in the tray 41 in order to use a small-diameter disk, the thickness of the tray 41 is increased, so that the turntable 58 must be retracted along an increased distance during the conveyance of the tray 41 within the device, thereby hindering the reduction in the thickness of the apparatus.

[0033] In particular, disk loading devices for notebook-sized personal computer are required to have a thickness of 20 mm or less. Therefore, the tray illustrated in either Conventional Example 1 or 2 cannot satisfy this demand.

[0034] Therefore, in view of the aforementioned problems of the prior art, an objective of the present invention is to provide a disk loading device capable of accepting both disks internalized within cartridges and bare disks, and which is capable of being formed in a thin configuration without creating a large redundant space within the device.

[0035] An objective of the present invention is to provide a disk loading device which is capable of, for a cartridge having a differently dimensioned shutter front end, securely holding the opened shutter with the cartridge being mounted, and which does not allow the shutter to be closed at impact.

[0036] An objective of the present invention is to provide a disk loading device which facilitates exchange of not only disks internalized within cartridges but also of bare disks.

[0037] An objective of the present invention is to provide a disk adapter to be mounted in a disk loading device which makes it possible to directly put in or take out small-diameter disks with an operation feeling similar to that of a cartridge, such that the adapter does not need to be drawn out every time small-diameter disks are exchanged.

[0038] An objective of the present invention is to provide a disk loading device which makes it possible easily take out a disk internalized within a cartridge or a bare disk even in the absence of supplied power.

[0039] An objective of the present invention is to provide a disk loading device which includes a clasper and yet is capable of being formed in a thin configuration without creating a large redundant space within the device.

[0040] An objective of the present invention is to provide a disk loading device which is capable of accurately positioning a cartridge with respect to a head so as to compensate for cartridge thickness variation and yet is capable of being formed in a thin configuration without creating a large redundant space within the device.

[0041] An objective of the present invention is to pro-

vide a disk loading device which can be used in a horizontal installation or a vertical installation to solve the aforementioned problems.

DISCLOSURE OF THE INVENTION

[0042] In order to solve the aforementioned problem, a disk loading device according to the present invention comprises: a holder for detachably retaining a cartridge; transfer means for transferring the holder; shutter opening/closing means for opening a shutter of the cartridge when the cartridge is inserted into the holder; and rotation driving means having a retention section for retaining a disk in the vicinity of a center thereof, the disk being within the cartridge having been transferred to a predetermined position by the transfer means, wherein the rotation driving means rotates the disk retained by the retention section, wherein, during transfer by the transfer means, an opening of the cartridge previously closed by the shutter of the cartridge passes where the retention section of the rotation driving means is with the shutter of the cartridge being opened by the shutter opening/closing means.

[0043] In accordance with the disk loading device of the present invention, the operation of opening a shutter is completed by a shutter opening/closing means which is provided at the rear end of a holder before a leading edge end of a cartridge passes over a clamp section. Therefore, the shutter is already in an open state when the leading edge end of the cartridge passes over the clamp section. As a result, a disk motor and the retreated position of a clasper can be located adjacent to each other, so that during a clamp operation, the amount of relative movement between the disk motor, the clasper, and the cartridge can be small. Since the entire thickness of the cartridge does not need to be retreated into the clamp section, a disk loading device in a thin configuration can be realized.

[0044] In one embodiment, the shutter opening/closing means is an arm pivotably supported by the holder such that the shutter is opened by a tip end of the arm being caught by the shutter of the cartridge when the cartridge is inserted into the holder, and during the transfer by the transfer means, the arm is pivoted so that the tip end of the arm moves in a manner to avoid the retention section of the rotation driving means.

[0045] In this case, the tip end of the arm from the holder for the cartridge does not interfere with the retention section of the rotation driving means. Therefore, the interspace between a turntable, which is the retention section of the rotation driving means, and the clasper can be reduced.

[0046] In one embodiment, during the transfer by the transfer means, the arm pivots as a result of a portion of the arm being caught by a guide of the holder and moving.

[0047] One embodiment comprises an energization means for energizing the tip end of the arm toward the

shutter of the cartridge while the cartridge is retained by the holder and the tip end of the arm is caught by the shutter of the cartridge.

[0048] In one embodiment, a shutter opening operation is securely performed without requiring the arm to move to the final end of the travel path of the arm and without allowing the arm to be disengaged from the shutter of the cartridge.

[0049] A disk loading device according to the present invention comprises a holder for retaining a cartridge accommodating a disk or a disk by itself, wherein the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof; and wherein the pair of interposition members include an inlet section which is wider than a width of the cartridge, and a retention section for interposing the cartridge at the opposite sides thereof, the cartridge having been inserted through the inlet section, wherein at least the retention section includes slits into which opposite ends of the disk by itself are respectively inserted.

[0050] According to the present invention, the cartridge is interposed between a pair of interposition members, and a bare disk is retained in slits in retention sections of the respective interposition members.

[0051] In one embodiment, the pair of interposition members comprise a pair of inlet levers and a pair of disk holders, wherein tip ends of the pair of inlet levers are supported so that the tip ends of the pair of inlet levers are wider than a width of the cartridge; wherein rear ends of the pair of inlet levers and tip ends of the pair of disk holders are mutually supported so as to elastically retain the respective disk holders; and wherein at least the pair of disk holders include slits into which opposite ends of the disk by itself are respectively inserted.

[0052] In this case, the pair of inlet levers are pushed apart by the cartridge when the cartridge is inserted. As a result, the tip ends of the pair of disk holders are spread, thereby allowing the cartridge to pass between the tip ends of the disk holders.

[0053] One embodiment comprises: first detection means for detecting insertion of either the cartridge or the disk by itself into the holder; and second detection means for detecting a state of the pair of interposing members.

[0054] In this case, the state of the pair of interposition members changes when the cartridge is retained, the state being detected by a second detection means. Based on the detection outputs from first and second detection means, it is possible to determine whether a cartridge or a disk by itself has been inserted into the holder.

[0055] An adapter according to the present invention is an adapter for detachably retaining a disk by itself, comprising: a recessed section for snugly receiving the disk; an introduction section for introducing the disk into the recessed section; and an elastic section provided between the recessed section and the introduction sec-

tion, the elastic section moving by being pushed by a rim of the disk toward outside of the recessed section when the disk is introduced from the introduction section to the recessed section, and the elastic section returning to a vicinity of the rim of the disk when the disk has been snugly received by the recessed section, wherein an opening is provided for allowing a central portion of the disk having been snugly received by the recessed section to be externally retained and for externally performing recording or reproduction to the disk.

[0056] According to the present invention, disks having different diameters can be used, and exchange of disks is possible while the adapter is mounted in the holder.

[0057] A disk loading device according to the present invention comprises: a holder for detachably retaining a cartridge; and a guide for movably supporting the holder, wherein the holder includes a locking member, and wherein the locking member protrudes from the holder so as to be caught by the guide responsive to the cartridge having been inserted into the holder.

[0058] In accordance with a disk loading device of the present invention, a mechanism for locking the holder to a guide responsive to the insertion of a cartridge is constructed. During the insertion of a cartridge, the holder can be secured by preventing the holder from being pushed into the guide because of, for example, a load due to the operation of opening the shutter of the cartridge. Thus, it is possible to securely mount the cartridge in the holder.

[0059] In one embodiment, the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof, and the locking member is provided on the pair of interposition members.

[0060] A disk loading device according to the present invention comprises: a holder for detachably retaining a cartridge; and a guide for movably supporting the holder, wherein the holder includes a locking member, and wherein the locking member protrudes from the holder so as to be caught by the guide responsive to the cartridge having been inserted into the holder, and, when the cartridge is mounted in the holder, the locking member is snugly received by the recessed section of the cartridge so as to be retreated into the holder and disengaged from the guide.

[0061] In accordance with a disk loading device of the present invention, a mechanism for locking the holder to a guide responsive to the insertion of a cartridge is constructed. During the insertion of a cartridge, the holder can be secured by preventing the holder from being pushed into the guide because of, for example, a load due to the operation of opening the shutter of the cartridge. Thus, it is possible to securely mount the cartridge in the holder. Furthermore, when the cartridge is mounted in the holder, the locking member is snugly received by a recessed section of the cartridge, so that it is possible to accurately position the cartridge within the holder. At the same time, since the locking member

is disengaged from the guide, it is possible to securely load the cartridge, along with the holder, after the cartridge is accurately positioned within the holder.

[0062] In one embodiment, the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof, and the locking member is provided on the pair of interposition members.

[0063] A disk loading device according to the present invention comprises: a holder for detachably retaining a cartridge; an elastic member provided on the holder, the elastic member being disposed in a vicinity of the cartridge retained by the holder; and an operation section for deforming the elastic member so that the deformed elastic member is caught by the cartridge, wherein the cartridge caught by the elastic member is ejected from the holder owing to elastic force of the elastic member restoring its original shape.

[0064] In accordance with a disk loading device of the present invention, a forced ejection function for forcing the cartridge to be ejected is realized. In a normal operation which does not utilize the forced ejection function, an elastic member is not caught by the cartridge. When the forced ejection function is utilized, the elastic member is deformed by the operation section, so that the deformed elastic member is caught by the cartridge. The cartridge which is caught by the elastic member is ejected from the holder owing to the elastic force of the elastic member restoring its original shape.

[0065] In accordance with the aforementioned constitution, a disk loading device can be realized in a thin configuration.

[0066] A disk loading device according to the present invention comprises: a holder for detachably retaining a cartridge; shutter opening/closing means for opening a shutter of the cartridge retained by the holder; and rotation driving means having a retention section for retaining a disk in the vicinity of a center thereof, the disk being within the cartridge whose shutter is opened, wherein the rotation driving means rotates the disk retained by the retention section, wherein, at least a portion of a mechanism for activating the retention section of the rotation driving section is disposed in a range overlapping with an opening of the cartridge previously closed by the shutter.

[0067] According to the present invention, at least a portion of a mechanism for activating the retention section of the rotation driving section is disposed in a range overlapping with an opening of the cartridge. The thickness of the opening of the cartridge is thinner than the entire thickness of the cartridge. As a result, by disposing at least a portion of the retention section of the rotation driving section in the opening of the cartridge, the retention section can be located closer to the disk. As a result, a disk loading device can be realized in a thin configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0068]

Figure 1 is an exploded perspective view showing the structure of a disk loading device according to an example of the present invention.

Figure 2 is a plan view showing the internal structure of a disk loading device according to the present example.

Figures 3A to D are perspective views of a cartridge and bare disks.

Figures 3E and F are a side view and a cross-sectional view of a cartridge.

Figure 4 is an exploded perspective view showing the internal structure of a holder in a disk loading device according to the present example.

Figure 5 is a perspective view of the holder of Figure 4 in an assembled state.

Figures 6A to C are a two-plane view showing a disk clamp mechanism in a disk loading device according to the present example.

Figure 7 is a perspective view showing a clamp lever in the disk clamp mechanism of Figures 6A to C.

Figures 8A to C are views illustrating an operation of the disk clamp mechanism of Figures 6A to C.

Figures 9A and B are structural views showing a base section of a disk loading device according to the present example.

Figure 10 is a block diagram showing a recording/reproduction apparatus to which a disk loading device according to the present example is applied.

Figure 11 is a circuit diagram of the vicinity of a switch in a disk loading device according to the present example.

Figures 12A to D are outer perspective views showing how a medium is inserted into a disk loading device according to the present example.

Figures 13A and B are plan views (i) showing a loading operation of a disk loading device according to the present example.

Figures 14A and B are plan views (ii) showing a loading operation of a disk loading device accord-

ing to the present example.

Figures **15A** and **B** are plan views (iii) showing a loading operation of a disk loading device according to the present example.

Figures **16A** to **C** are detailed upper plan views (i) showing a loading operation of a disk loading device according to the present example.

Figures **17A** to **C** are detailed upper plan views (ii) showing a loading operation of a disk loading device according to the present example.

Figures **18A** to **C** are detailed lower plan views (i) showing a loading operation of a disk loading device according to the present example.

Figures **19A** to **C** are detailed lower plan views (ii) showing a loading operation of a disk loading device according to the present example.

Figures **20A** to **D** are side cross-sectional views showing a loading operation of a disk loading device according to the present example (with no medium mounted therein).

Figures **21A** to **C** are plan views (i) showing a holder operation at the time of inserting a cartridge in a disk loading device according to the present example.

Figures **22A** and **B** are plan views (ii) showing a holder operation at the time of inserting a cartridge in a disk loading device according to the present example.

Figures **23A** to **E** are enlarged views showing a cartridge lock mechanism and a holder lock mechanism in a disk loading device according to the present example.

Figure **24** is a plan view of a holder in a disk loading device according to the present example, where a cartridge having a differently dimensioned shutter front end is mounted.

Figures **25A** to **D** are side cross-sectional views showing a loading operation of a disk loading device according to the present example (with a cartridge mounted therein).

Figures **26A** to **C** are principle diagrams showing a cartridge allowable error compensating mechanism in a disk loading device according to the present example.

Figures **27A** to **C** are plan views (i) showing a

holder operation at the time of inserting a large-size disk in a disk loading device according to the present example.

Figure **28** is a plan view (ii) showing a holder operation at the time of inserting a large-size disk in a disk loading device according to the present example.

Figure **29A** is a partial enlarged view of a disk loading device according to the present example retaining a large-size disk. Figure **29B** is a side view of a disk holder and a disk.

Figures **30A** and **B** are partial cross-sectional views of a disk retention section in a disk loading device according to the present example.

Figure **31A** is a side view of a disk holder and a disk in a disk loading device according to the present example. Figure **31B** is a side view showing how a disk is inserted.

Figures **32A** to **D** are side cross-sectional views showing a loading operation of a disk loading device according to the present example (with a large-size disk mounted therein).

Figures **33A** and **B** are detailed upper plan views (i) showing a cartridge take-out operation in a disk loading device according to the present example in an unpowered state.

Figures **34A** and **B** are detailed upper plan views (ii) showing a cartridge take-out operation in a disk loading device according to the present example in an unpowered state.

Figures **35A** to **D** are side cross-sectional views showing a cartridge take-out operation in a disk loading device according to the present example in an unpowered state.

Figures **36A** to **D** are side cross-sectional views showing a cartridge take-out operation engagement section in a disk loading device according to the present example in an unpowered state.

Figure **37** is a perspective view showing a first example of an adapter according to the present invention.

Figure **38** is a perspective view showing a second example of an adapter according to the present invention.

Figures **39A** to **C** are plan views and cross-sectional views showing how a disk is inserted in the

adapter of Figure 37.

Figures 40A to C are plan views showing how the adapter of Figure 37 is mounted to a holder.

Figure 41 is a perspective view showing a disk loading mechanism according to Conventional Example 1.

Figures 42A and B are side views showing the disk loading device of Figure 41.

Figure 43 is a schematic diagram showing relative dimensions of the disk loading device of Figure 41 along the thickness direction.

Figure 44 is a perspective view showing a disk loading mechanism according to Conventional Example 2.

Figures 45A to C are side views showing the disk loading device according to Conventional Example 2.

BEST MODES FOR CARRYING OUT THE INVENTION

[0069] Hereinafter, the present invention will be described in detail with reference to the accompanying figures.

[0070] First, the structure of an exemplary disk loading device according to the present invention will be described with reference to the figures.

[0071] Although the disk loading device according to the present example can be used in a horizontal or vertical installation, the following description will illustrate the disk loading device in a horizontal installation for the sake of explanation.

[0072] The present example is directed to bare disks such as music CDs and CD-ROMs having a diameter of 12 cm (hereinafter referred to as large-size disks), and smaller bare disks such as 8 cm single CDs (hereinafter referred to as small-size disks) having a smaller diameter than that of large-size disks, and large-size disks accommodated within cartridges (hereinafter referred to as cartridges). These three forms of recording media will be collectively referred to as media. Of interest to the disk loading device are forms of media; their recording/reproduction methods, recording density, and the like are not limited to the above examples.

[0073] First, the overall structure of a disk loading device will be described, followed by a detailed description of each section.

(Overall structure of disk loading device)

[0074] Figure 1 is an exploded perspective view showing the structure of a disk loading device according to an

example of the present invention. Figure 2 is a plan view showing the internal structure thereof. Figures 3A to D are perspective views of a cartridge and bare disks. Figures 3E and F are side views of a cartridge. Figure 4 is an exploded perspective view showing the structure of a holder in the disk loading device.

[0075] With reference to Figure 1, the disk loading device according to the present example includes a base section U1, a holder section U2, and a clamp section U3.

[0076] The coordinate system for indicating directions in the figures includes a depth direction X, a width direction Y, and a height direction Z of the device.

[0077] The base section U1 incorporates a chassis 3, which in turn includes an optical head 7 and a turntable-integrated disk motor mounted on a base 8, and an elevation mechanism for moving it up or down. A holder 100 of the holder section is placed on guide sections on the side faces in the base 8, whereupon a ceiling 25 of the clamp section is attached.

[0078] The ceiling 25 has attached thereto a clamp lever 27 with a damper 26, constituting the clamp section U3.

[0079] The holder 100 of the holder section U2 incorporates a loading motor 111 and a gear array 112. The last gear 112a in the gear array 112 engages with a rack 13a provided in a slide rack 13 attached to the base 8 so that the holder 100 is driven along the X1-X2 direction. A driving current for the loading motor 111 is supplied from the base side via a flexible substrate 113.

[0080] Furthermore, the holder 100 incorporates a pair of right and left disk retention mechanisms for guiding and retaining a bare disk, a shutter opener 103 for opening and shutting the shutter of a cartridge, a lock mechanism for a cartridge, a lock mechanism for the holder, and a cartridge energizing spring.

[0081] Switches 114 and 115 are provided on the flexible substrate 113, which are turned ON/OFF by the shutter opener 103 and a junction plate 108, respectively.

[0082] As shown in Figure 2, the base section U1 incorporates the holder section U2. The holder 100 is drawn out by its incorporated loading motor 111 in the X1 direction by a distance S shown in Figure 2 so that a half of a retained disk will be exposed, thereby entering a media exchange stand-by state.

(Media to be used)

[0083] Figure 3A is a perspective view of a cartridge 300 with its shutter 300a being closed. Reference numeral 300c denotes a notch for retention purposes; 300f denotes a positioning hole.

[0084] When the cartridge 300 is inserted part of the way into the holder 100, a tip end of the shutter opener 103 of the holder 100 engages with a recess 300b in the front end of the shutter 300a. As the cartridge 300 is inserted deeper, the shutter 300a opens to enter the

state shown in Figure 3B, so that a disk 300e accommodated therein is exposed. At this time, a thin junction section 300d is also exposed which has a smaller thickness than that of the cartridge 300.

[0085] Figure 3C shows a large-size disk 301, and Figure 3D shows a small-size disk 302.

[0086] Figure 3E shows a side view of the cartridge 300, and Figure 3F shows a cross-sectional view of the cartridge 300.

[0087] The cartridge 300 has a thickness M. When the shutter 300a of the cartridge 300 is opened, its opening has a thickness m, where m is smaller than M.

[0088] Hereinafter, the respective sections of the disk loading device will be described in detail.

(Structure of holder section)

[0089] First, the structure of the holder 100 will be described.

[0090] Figure 4 is an exploded perspective view showing the internal structure of the holder 100, whereas Figure 5 is a perspective view in its assembled state.

[0091] With reference to Figure 4, a holder cover 102 is attached upon a holder case 101, whereby the box-like holder 100 is constructed. The opening provided in the X1 direction serves as a medium insertion inlet for allowing a medium to be inserted in the X2 direction. Its internal space has a height which is equal to the thickness of the cartridge 300 plus an appropriate inter-space, and a width which is equal to the width of the cartridge plus a margin for allowing a retention mechanism for a bare disk (described later) to retract. The bottom face of the holder case 101 has an opening, through which an optical head is inserted from below, and its central portion at the farthest back is notched from above and below so as to define a thin junction section 101a. The holder cover 102 is split into right and left portions, so that a space is provided in the central portion of the holder which has the same width as that of the junction section 101a.

[0092] The insertion inlet of the holder case 101 and the holder cover 102 is configured so that its opposite (right and left) ends protrude in the X1 direction, leaving a recess in the center. Only at the right and left protrusions does the bottom face of the holder case 101 further inwardly extend from the holder cover 102, whereby a receptacle 101h is defined. When the cartridge 300 is inserted, the leading edge of the cartridge 300 is first placed on the receptacle 101h to facilitate the insertion.

[0093] Provided at the back end of the holder 100 are a portion for attaching the loading motor 111 and the driving gear array 112, a portion for attaching the shutter opener 103, a portion for attaching the junction plate 108 and a holder lock 109, and two projections 100a and 100b which are under the bottom face. Otherwise the structure is bilaterally symmetrical.

[0094] The last gear 112a in the driving gear array protrudes under the holder through a hole 101c in the

bottom face of the holder case 101 so as to cooperate with the driving mechanism incorporated in the base 8. The operations of the gear 112a and the two projections 100a and 100b will be described later.

[0095] The shutter opener 103 is incorporated so as to be pivotable around an axis 100e which is formed by a hole and a boss provided at the same position in the holder case 101 and the holder cover 102. A projection 103a engages with an arc groove 100f which is concentric with the hole 100e, thereby restraining the pivoting angle. As the projection 103a of the shutter opener 103 is energized by a spring 160 to an end of the arc groove 100f near the medium insertion inlet, the tip end 103b comes to a position where it abuts with the recess 300b of the cartridge shutter 300a which has been inserted in the holder case 101. The tip end 103b of the shutter opener 103 is of a cylindrical configuration having a height which is substantially equal to the thickness of the cartridge 300, and is notched at its end facing an inserted medium so as to leave the upper and lower ends thereof. As a result, once the end face of an inserted bare disk abuts with the tip end 103b, the end face of the bare disk is prevented from sliding upward or downward out of engagement with the tip end 103b.

[0096] A projection 103d which is disposed at the opposite end of the shutter opener 103 laterally protrudes through a hole 101d in a side face of the holder case 101, and is accommodated within the holder as the shutter opener 103 pivots toward the rear. When the holder 100 is drawn out of the device to enter a media exchange state, the projection 103d is received in an outlet hole 8e in the side wall of the base 8 located in a position corresponding to the hole 101d, so that the tip end of the shutter opener 103 is pivoted in the X1 direction. When the holder 100 is drawn in, the projection 103d is pressed by the side wall of the base 8 so that the projection 103d will be accommodated within the holder, causing the shutter opener 103 to quickly pivot to the back end of the holder.

[0097] An arm 103c of the shutter opener 103 is notched from above and below so as to have a thickness which is substantially equal to that of the junction section 101a at the back end of the holder case 101.

[0098] A projection 103e on the shutter opener 103 turns ON the switch 114 provided on the flexible substrate 113 at a certain angular position of the shutter opener 103.

[0099] An opener plate spring 103f provided on the shutter opener 103 abuts with the back end wall of the holder case 101 at the end of the pivotal action of the shutter opener 103 so as to energize the shutter opener 103.

[0100] Next, a holder lock mechanism will be described.

[0101] The holder lock mechanism includes inlet levers 107, a junction plate 108, and the holder lock 109.

[0102] The holder lock 109 has a hook 109a and an

elevated portion 109b, and is attached to the lower face of the junction plate 108 so as to be pivotable around an axis 109d. The junction plate 108 is attached so as to be pivotable around the axis 100e within an indentation 101f provided in the bottom face of the holder case 101. The holder lock 109 is energized by the spring 160 so that the elevated portion 109b is forced toward the inside of the holder.

[0103] An elongated hole 108a at a tip end of the junction plate 108 engages and cooperates with a projection 107b at a tip end of an inlet lever 107. The inlet lever 107 is attached so as to be pivotable around an axis 100i within an arc groove 100g, and is energized, along with a disk holder 104, toward the inside of the holder by a spring 105. Immediately following the insertion of the cartridge 300, the inlet levers 107 are pushed toward the outside of the holder, and the junction plate 108 also pivots toward the outside, so that the hook 109a of the holder lock 109 protrudes out through a hole 101g in the side face of the holder case 101. In this state, the elevated portion 109b of the holder lock 109 stands in the pathway of the cartridge 300. When the cartridge 300 reaches the rear, the elevated portion 109b is pushed outward, and the hook 109a conversely pivots toward the inner side so as to be accommodated within the holder. In other words, the hook 109a is arranged so as to protrude out of the holder only during the insertion of the cartridge 300.

[0104] A projection 108b on the junction plate 108 usually keeps the switch 115 provided on the flexible substrate 113 in an ON state, but turns the switch 115 OFF immediately after the junction plate 108 pivots along with the pivoting of the inlet levers 107.

[0105] Next, a cartridge lock mechanism will be described.

[0106] The rear end of each disk holder 104 defines an elastic structure including projections 104e and 104f and an arm 104g. When the cartridge 300 is inserted, the inner projections 104f are pushed outward by the side faces of the cartridge 300 so that the outer projections 104e temporarily protrude to the holder side faces. When the notches 300c of the cartridge 300 reach where the projections 104f are, the projections 104f slip into the notches 300c so that the projections 104e and 104f return to their original positions due to the elasticity of the arms 104g.

[0107] Finally, a disk retention mechanism for guiding and retaining a bare disk will be described.

[0108] The disk retention mechanism includes the disk holders 104, the holder plate spring 105, and the inlet levers 107.

[0109] Each disk holder 104 restrains the position of a bare disk along the height direction with a slit 104a having a slope toward the inside of the holder, and restrains the position of the bare disk along the radius direction with retention sections 104b at opposite ends of the slit 104a.

[0110] The disk holders 104 engage with the inlet

levers 107 in a pivotable manner at their tip ends, so that projections 104d provided in two positions, i.e., above and below, are inserted into respective guide grooves 100h provided in the holder case 101 and the holder cover 102.

[0111] The inlet levers 107 are mounted so as to be pivotable around the axis 100i. Projections 107b are inserted in the arc grooves 100g, and energized, along with the disk holders 104, toward the inside of the holder by the holder plate spring 105. Usually, the projections 104d and 107b are stopped where they abut with the respective ends of the guide grooves 100h and the arc grooves 100g nearer the inside of the holder. At this time, the pair of (right and left) disk holders 104 are maintained in parallel to the X direction, so that the interspace therebetween is smaller than the diameter of the bare disk to be inserted.

[0112] The inserted bare disk abuts with the tip end of the shutter opener 103 and, while causing the shutter opener 103 to pivot toward the rear, temporarily press open the tip ends of the inlet levers 107 and the disk holders 104 and then slip into the slits 104a, so that the disk holders 104 return to their original positions.

[0113] At this time, the shutter opener 103 is abutting with the bare disk with the aforementioned switch 114 still being in the OFF state. By slightly pressing in the bare disk so as to press open the rear ends of the disk holders 104 from this position, the projection 103e on the shutter opener 103 turns ON the switch 114. When the bare disk is let go of, the disk holders 104 return to their original positions.

[0114] By ensuring that the four abutting sections 104b are disposed wide apart relative to the diameter of the bare disk so as to secure a predetermined interspace between the outer plurality of the disk, and a predetermined interspace between the width of the slits 104a and the disk thickness, the rotation operation of the disk becomes possible with the disk holders 104 being in their original positions.

[0115] When the cartridge 300 is inserted, corners of the cartridge 300 press the inlet levers 107 toward the outside of the holder. In order to allow for smooth press-down, indentations are provided in the abutting faces. As the inlet levers 107 pivots the disk holders 104 also move, causing the tip ends of the disk holders 104 to open wide. As the cartridge 300 is further inserted, the disk holders 104 are also pressed down by the cartridge 300, so that the disk holders 104 and the inlet levers 107 are accommodated in line at the right and left ends of the holder, thereby securing a pathway for the cartridge 300.

[0116] As will be seen from the above configuration, the disk holders 104 stand by in a position where they are capable of retaining a bare disk. When the cartridge 300 is inserted, its corners will press the inlet levers 107, causing the disk holders 104 to be retracted and accommodated at the right and left ends of the holder.

[0117] The holder case 101 incorporates a cartridge

energizing spring 120, which presses the front corners of the cartridge 300 in the direction of the holder cover 102 (i.e., the Z1 direction).

(Structure of clamp section)

[0118] Next, the structure of a clamp section will be described.

[0119] Figures 6A to C show a disk clamp mechanism. Figure 6A is a plan view; Figure 6B is an elevated cross-sectional view showing a state where a clamp is not mounted; and Figure 6C is an elevated cross-sectional view showing a state where a clamp is mounted. Figure 7 is a perspective view showing a clamp lever.

[0120] In Figures 6A to C, reference numeral 301 denotes a large-size disk; 2 denotes a disk motor; and 26 denotes a clamp.

[0121] Reference numeral 25 denotes a ceiling; and 25a denotes a fulcrum around which the clamp lever 27 pivots so as to move up or down the clamp (states shown in Figures 6B and C).

[0122] Reference numeral 25b denotes a reference pin; and 25c denotes a fold for restraining the pivoting of the clamp lever. Reference numeral 27 denotes the clamp lever according to the present invention, at a tip end of which is a hole 901 for incorporating the clamp 26 therein, and at the other end of which is a point of action 902 for generating force f for pivoting the clamp lever. Reference numeral 903 denotes a cantilever elastic plate spring which is stripped out of the clamp lever from the fulcrum toward the clamp 26. A reference hole 904 and a screw hole 905 are provided at a tip end of the cantilever elastic plate spring 903, where it is affixed to the ceiling 25 with a screw. The affixation can also be achieved by methods such as caulking, welding, or the like.

[0123] Reference numeral 906 denotes a fold for providing width restraint, which engages with the fold 25c provided on the ceiling for restraining the pivoting of the clamp lever.

[0124] The initial state of the cantilever elastic plate spring 903 is shown at a double-dot-dash line 903' in Figure 6B. Its initial deflection generates pressing force F against the ceiling and restoration spring force F_m .

[0125] Figure 7 is a perspective view showing the clamp lever, which is provided so as to fit within a window opening that emerges as the shutter 300a of the cartridge 300 opens. Thus, it is possible to implement the disk loading device in a thin configuration.

[0126] Figure 8A shows the structure of the clamp 26. A magnetic element 26d and a magnet 26c are housed in a damper 26b, which is provided within a central hole of the clamp lever 27 composed of a magnetic material, and stabilized by a clamp cover 26a. In this state, which defines a magnetically stable state between the clamp 26 and the clamp lever 27, the clamp 26 magnetically floats in such a manner that the magnetic element 26d moves away from the clamp lever 27 with the magnet

26d interposed therebetween.

[0127] Figure 8B shows the case where the disk motor 2 is in the vicinity of the clamp 26. In this case, the clamp 26 is attracted to a magnetic element of the disk motor 2, so that the magnetic floating between itself and the clamp lever 27 is deactivated. If there is a disk, the disk is subjected to magnetically attraction onto the turntable of the disk motor 2 by means of the clamp 26.

[0128] Figure 8C shows the case where the disk motor 2, which includes a magnetic element at a portion adjacent to the clasper, is not in the vicinity of the clamp 26. In this case, which defines a magnetically stable state between the clamp 26 and the clamp lever 27, the clamp 26 magnetically floats away from the disk motor 2.

(Structure of base section)

[0129] Figures 9 are views showing the base section of the disk loading device according to the present invention: Figure 9A is a plan view only showing the base section, and Figure 9B is a side cross-sectional view.

[0130] With reference to Figure 9A, reference numeral 1 denotes a housing for the disk loading device. A printed circuit board 20 carrying circuit elements for recording/reproduction mounted thereon, a panel 21, and a shutter 22 for shutting an opening 21a at the front of the housing 1 when the holder 100 is accommodated are mounted on the housing 1.

[0131] On the panel 21, a button (not shown) for expelling or accommodating the holder 100 and a hole for forced ejection (not shown) for taking out the cartridge 300 or a bare disk (i.e., the large-size disk 301 or the small-size disk 302) in an unpowered state.

[0132] Reference numeral 8 denotes a base which is elastically supported by the housing 1 via dampers 9 for alleviating the external vibration or shock. A torsion leaf 11 is affixed to the chassis 3. The torsion leaf 11 is mounted to the base 8 so as to constantly energize a tip end 3a of the chassis 3 in the Z2 direction.

[0133] An elevation cam 10 is axially supported by an axis 8a of the base 8. When the cam 10 is pivoted in the direction of arrow R1 by the driving means composed of the deceleration device 112 and the loading motor 111 provided in the holder 100, the elevation cam 10 engages with a slit 3b of the chassis 3 at a slope 10a, so as to push up the tip end 3a of the chassis 3 in the Z1 direction against the spring energization force of the torsion leaf 11, and orient the chassis 3 to be substantially horizontal. At this time, the chassis 3 is supported by a horizontal face at an end of the slope 10a. When the elevation cam 10 is pivoted in the direction of arrow R2, the chassis 3 is tilted from the horizontal position along the slope 10a of the elevation cam 1, in the Z2 direction, by the spring energization force of the torsion leaf 11. A head unit energization spring (not shown) is provided between the elevation cam 10 and the base 8, so that

the holder 100 is spring-energized against the ceiling 25 via the chassis 3.

[0134] The slide rack 13 has the rack structure 13a, which engages with the gear 112a, on its upper face. A groove 13b engages with a projection 8b of the base 8 so as to be retained so as to be slidable along the X1-X2 direction, and a groove 13c engages with a pin 10b of the elevation lever 10. When a claw 12c of a clutch 12 engages with a projection 8c of the base 8 so as to stabilize the slide rack 13, the holder 100 becomes capable of moving. When the engagement between the claw 12c of the clutch 12 and the projection 8c of the base 8 is canceled, the slide rack 13 slides so that the elevation cam 10 can pivot. The rib 10a of the slide rack elevation cam 10 abuts with a driving detection switch 23b at the completion of the loading operation, i.e., when the accommodation of the holder 100 is completed thereby orienting the chassis 3 substantially horizontal, and a central processing unit (MPU) orders stopping the driving means.

[0135] The forced ejection lever 14 is energized in the X1 direction by a forced ejection spring 15, and retained between the base 8 and the slide rack 13 so as to be slidable between the X1-X2 direction. The forced ejection lever 14 has a claw 14a which engages with an engagement section 100c in a lower portion of the holder 100. When taking out a medium which is stored in the holder 100 in an unpowered state, e.g., when power failure occurs, a pin is thrust in the X2 direction through a hole for forced ejection (not shown) in the panel 21, and while compressing the forced ejection spring 15 with the pin, the claw 14a is engaged with the projection 100c in the lower portion of the holder 100. By subsequently releasing the forced ejection spring 15, the holder 100 being engaged with the claw 14a is ejected out of the device. Then, by manually pulling the holder 100 to the expelled position, the cartridge 300 or the bare disk which is stored within the holder 100 can be taken out.

[0136] A disk restraining member 29 is composed of a roller 29a, which is formed of a rubber of lower hardness than PC (polycarbonate) which serves as the disk substrate, and a coil spring 29b (shown in Figures 20A to D and Figures 25A to D). The disk restraining member 29 contacts the bare disk stored in the holder 100 and the disk 300e within the cartridge 300 between the completely expelled position and the completely accommodated position of the holder 100, thereby restraining postures of these disks and the chassis 3 obliquely energized with respect to the base 8 so that they become substantially parallel and preventing each disk from contacting the turntable 2 on the chassis 3. Once the accommodation of the holder 100 into the disk loading device is completed, a lower face 100d of the holder 100 and the roller 29a abut with each other so that the disk restraining member 29 is stored into the base 8, thereby canceling the restraint on these disks by the disk restraining member 29.

[0137] Further provided on the base 8 are the clutch

12 for switching the motion of the slide rack 13, and a driving detection circuit board 23 having a switch 23a for detecting the completion of expelling of the holder 100 and the switch 23b for detecting the completion of storage of the holder 100.

[0138] Provided on the chassis 3 are the disk motor 2 integral with the turntable 2a, guide shafts 6, a feed motor 5, a cartridge detection circuit board 18 which is elastically supported via a switch circuit substrate support 17, and a pin 16 for cartridge positioning. On the face of the turntable 2a opposing the clamp 26, a magnetic element (not shown) is provided which generates attraction force to the magnet (not shown) within the clamp 26.

[0139] On the guide shafts 6, a head transfer lever 4 is provided so as to be movable along the X1-X2 direction between the chassis 3, with one end being capable of abutting with the optical head 7 and the other end being capable of abutting with the forced ejection lever 14.

[0140] The optical head 7, which is mounted on the guide shafts 6 and reciprocates along the X1-X2 direction by the action of the feed motor 5, includes a laser emission section for recording/reproduction purposes and a light sensitive portion for receiving reflected light from the disk (300e, or 301, 302).

[0141] Reference numeral 26 denotes a clamp which is mounted to the ceiling 25. A magnet (not shown) for being attracted to the turntable 2a so as to retain a disk is provided within the clamp 26. The clamp 26 is energized away from the turntable 2a, via the clamp lever 27 protruding from the ceiling 25 toward the holder 100, by a clamp pressuring spring 28. The ceiling 25 is mounted to the base 8 by of a mounting means such as an anchor claw. When the holder 100 has moved from the completely expelled position to the completely accommodated position, the clamp lever 27 is pushed by the operation piece 101a so that the clamp 26 pivots against the clamp pressuring spring 28, thereby pressing each disk onto a center cone of the turntable 2a. On the other hand, once the holder 100 begins to move toward the expelled position, the operation piece 101a is detached from the clamp lever 27, so that the clamp 26 is detached from the turntable 2a.

[0142] The clamp 26 will be unnecessary where a method is employed in which the disk itself has a magnetic metal hub and the turntable 2a has a magnet so that the magnet attracts the metal hub for retaining the disk. Thus, depending on each method, mechanisms may be incorporated as required.

[0143] Figure 10 is a block diagram showing a recording/reproduction apparatus to which the disk loading device according to the present example is applied. This recording/reproduction apparatus is provided on the main chassis 3 and the circuit board 20.

[0144] In this recording/reproduction apparatus, a laser driving circuit 30 controls the optical head 7 so that laser light is radiated from the optical head 7 onto the

disk (300e or 301, 302) and a signal from the disk is received by the light sensitive portion of the optical head 7. The output from the optical head 7 is processed by a reproduced signal processing circuit 31, and the output from the reproduced signal processing circuit 31 is demodulated by a modulation/demodulation circuit 32, so that the data which has been obtained as a result of the demodulation is output, via a memory 33, to an external personal computer 35. Upon receiving the data from the external personal computer 35 via the memory 33, the modulation/demodulation circuit 32 modulates the data and feeds it to the laser driving circuit 30. The laser driving circuit 30 controls the optical head 7 so that laser light is radiated from the optical head 7 onto the disk (300e or 301, 302), thereby recording the modulated output from the modulation/demodulation circuit 32 on the disk. The central processing unit 34 has overall control of the recording/reproduction apparatus.

[0145] Figure 11 is a structural diagram showing how the respective switches in the holder 100 and the base 8 are interconnected.

[0146] The switches 114 and 115 of the holder 100 are connected in series, and are monitored by the central processing unit 34 along with the switches 23a and 23b of the base 8 so that the switches 114 and 115 are only activated when at the completion of expelling of the holder 100 (i.e., the switch 23a is in an ON state).

[0147] Specifically, when a bare disk is inserted into the holder 100, the shutter opener 103 turning the switch 114 ON, the central processing unit 34 controls the driving of the loading motor 111 via the motor driving circuit 36.

[0148] When a cartridge is inserted, the inlet levers 107 will pivot first so that the junction plate 108 turns the switch 115 OFF. Therefore, even if the shutter opener 103 turns the switch 114 ON during insertion of a cartridge, the loading motor will not be driven.

[Operation of the Example]

[0149] The operation of the disk loading device having the aforementioned structure will now be described.

[0150] Figures 12 are outer perspective view showing how a medium is inserted. Owing to the aforementioned constitution of the holder 100, the loading mechanism can be used in either a vertical or horizontal posture. Figures 12A and B show the insertion of a cartridge. Figures 12C and D show the insertion of a large-size disk.

[0151] The outline of the loading operation is as follows: When a button provided on the front face of the device is pressed, the holder 100 is drawn out to a position shown in the figures, thereby entering a media insertion stand-by state. From this state, by pressing the button again or pushing the holder 100 in, the holder 100 will be drawn into the device.

(I) Loading operation when no medium is mounted in the holder

[0152] Figures 13A, B through Figures 15A, B show plan views showing a loading operation with no medium mounted in the holder 100. Figures 13A, B through Figures 15A, B show chronological operation states.

[0153] Figures 16A to C through Figures 17A to C show detailed plan views of an upper portion of the disk loading device with no medium mounted in the holder 100. Figures 16A to C through Figures 17A to C correspond to Figures 13A, B through Figures 15A, B.

[0154] Figures 18A to C through Figures 19A to C show detailed plan views of a lower portion of the disk loading device with no medium mounted in the holder 100. Figures 18A to C through Figures 19A to C correspond to Figures 13A, B through Figures 15A, B.

[0155] Figure 20 shows a side cross-sectional view showing a loading operation with no medium mounted in the holder 100. Figures 20A to D show chronological operation states.

[0156] Figure 13A shows a state in which the expelling of the holder 100 has been completed. The rib 100a on the lower face of the holder 100 abuts with the switch 23a on the driving detection switch circuit board 23 so as to stop precisely at the expelled position of the holder 100. In this state, either a bare disk or a cartridge will be selectively mounted. In the state of Figure 16A, the claw 12c of the clutch 12 engages with the rib 8c of the base 8 so that a boss 12a restrains the sliding of the slide rack 13, whereby the slide rack 13 is affixed to the base 8. As shown in Figure 18A, the projection 103d of the shutter opener 103 is pivotably provided corresponding to the hole 8e in the side wall of the base 8. When the cartridge 300 is mounted in the holder 100, the shutter opener 103 pivots, responsive to the insertion of the cartridge 300 into the holder 100, so that the shutter 300a can be opened.

[0157] In this state, as shown in Figure 20A, the chassis 3 is obliquely energized with respect to the base 8, and the clamp 26 is pressed against the ceiling 25 via the clamp lever 27 owing to the energization force of the clamp pressuring spring 28. The cartridge detection circuit board 18 is pressed toward the bottom face of the base 8 by the switch circuit substrate support 17. The disk restraining member 29 is lifted from the base 8 to the central opening of the holder 100 owing to the restoration spring force of the coil spring 29b.

[0158] Figure 13B shows an accommodation start state of the holder 100. As shown in Figure 16B, when a button (not shown) on the panel 21 is pressed and the loading motor 111 in the holder 100 rotates so that the driving force is transmitted to the driving gear 112a via the gears 112, the holder 100 begins moving in the X2 direction in engagement with the rack section 13a of the slide rack 13 attached to the base 8. At this time, as shown in Figure 18B, the projection 103d of the opener 103 leaves the hole 8e in the side face of the base 8. As

a result, in the case where a large-size disk 301 is mounted in the holder 100 or where no medium has been mounted, the shutter opener 103 pivots in the R2 direction up to a position where it does not interfere with the large-size disk 301. In this state, as shown in Figure 20B, the holder 100 will be gradually accommodated into the device.

[0159] Figure 14A shows a state in which the holder 100 is further accommodated into the disk loading device.

[0160] Figure 14B shows a state in which the accommodation of the holder 100 into the disk loading device has been completed. As shown in Figure 17A, the rib 100b on the lower face of the holder 100 abuts with a claw 12d of the clutch 12 so as to cancel the engagement with the rib 8c of the base 8. As a result the slide rack 13 is released from the restraint by the clutch 12 and thereafter becomes capable of sliding in the X1 direction.

[0161] At the same time, as shown in Figure 17A, a rectangular hole 101b of the holder 100 engages with a boss 12b of the clutch 12. In this state, the rib 101a of the holder 100 abuts with an end 27a of the clamp lever 27 as shown in Figure 20C, so that the clamp lever 27 pivots around the clamp pressuring spring 28, and the clamp 26 is lowered to a position opposing the turntable 2a. The roller 29a of the disk restraining member 29 abuts with the lower face 100d of the holder 100, and the disk restraining member 29 is stored into the base 8.

[0162] Figure 15A shows the operation of the slide rack 13 after the accommodation of the holder 100 into the disk loading device is completed. As shown in Figure 17B, the slide rack 13 slides in the X1 direction owing to the driving force of the driving gear 112a, and the boss 12b of the clutch 12, which has been engaged with the slide rack 13, pivots in the R1 direction so as to restrain the operation of the holder 100 in the X2 direction within the rectangular hole 101b of the holder 100. As a result, the holder 100 is retained in a predetermined position of the base 8. As the elevation cam 10, which is engaged with the boss 10b in a groove 13c of the slide rack 13, pivots in the R1 direction around the axis 8a of the base 8 concurrently with the movement of the slide rack 13 in the X1 direction, the chassis 3 abuts with the oblique rib 10a at the slit 3b of the chassis 3, and is gradually lifted up from an oblique state to a substantially horizontal state, in accordance with the pivoting of the elevation cam 10 and against the energization force of the torsion leaf 11.

[0163] Figure 15B shows a state in which the travel of the slide rack 13 has been completed. As shown in Figure 17C, the travel of the slide rack 13 in the X1 direction owing to the driving force of the driving gear 112a is completed so that the chassis 3 goes on the horizontal plane of the oblique rib 10a responsive to the pivoting of the elevation cam 10 in the R1 direction, and the chassis 3 is oriented substantially horizontal. The rib 10a of the elevation cam 10 abuts with the driving detection

switch 23b at the completion of the loading operation, i.e., when the chassis 3 is oriented substantially horizontal, and the central processing unit (MPU) 34 stops the loading motor 111. In this state, the chassis 3 is oriented substantially horizontal when the pivoting of the chassis 3 is completed as shown in Figure 20D. The turntable 2a on the chassis 3 is lifted to a position opposing the clamp 26, and the cartridge detection circuit board 18 is lifted from the base 8 to a predetermined position in the holder 100 owing to the restoration force of the switch circuit substrate support 17, whereby the loading operation is completed.

[0164] The expel operation of the holder 100 occurs by the opposite procedure to the above operations. As the loading motor 111 rotates in the opposite direction to the above, the slide rack moves in the X2 direction so as to pivot the elevation cam 10 in the R2 direction so that the chassis 3 pivots in the Z2 direction. Once the travel of the slide rack 13 in the X2 direction is completed, the holder 100 begins moving in the X1 direction owing to the driving force of the driving gear 112a, so that the boss 12b of the clutch 12, which has been engaged with the rectangular hole 101b of the holder 100 to restrain the holder 100, begins pivoting in the R2 direction. Due to the pivoting of the clutch 12 in the R2 direction, the claw 12c of the clutch 12 engages with the boss 8b of the base 8, so that the slide rack 13 is affixed to the base 8 by the boss 12a of the clutch 12. Thereafter, the holder 100 is expelled out of the disk loading device until the rib 100a on the lower face of the holder 100 abuts with the switch 23a of the driving detection circuit board 23, and stops at the completely expelled holder position shown in Figure 13A.

(II) Loading operation when a cartridge is mounted in the holder

[0165] First, the operation of inserting the cartridge 300 in the withdrawn holder 100 will be described.

[0166] Figures 21A to C through Figures 22A, B show plan views showing the operation of the holder 100 when inserting the cartridge 300 into the holder 100. Figures 21A to C through Figures 22A, B show chronological operation states.

[0167] Figures 23A to E are partially enlarged views showing a cartridge lock mechanism and a holder lock mechanism.

[0168] Figure 21A shows a stand-by state in which the holder 100 has been drawn out.

[0169] The disk holders 104 stand by in a position where they are capable of retaining the large-size disk 301. At this time, the switch 115 is placed in an ON state due to the projection 108b of the junction plate 108.

[0170] Figure 21B shows a state in which the cartridge 300 has been slightly inserted. The inlet levers 107 at the ends of the inlet are pushed out with a slight force, and in cooperation, the junction plate 108 and the holder lock 109 pivots outward in an integral manner, so

that the hook **109a** of the holder lock **109** engages with a hole **8g** in the side wall of the base **8**, whereby the holder **100** is locked so as not to be drawn into the base **8**. At the same time, the projection **108b** of the junction plate **108** is disengaged from the switch **115**, creating an OFF state (see Figure 23B).

[0171] In Figure 21C, when the cartridge **300** is further inserted, the disk holders are also outwardly pushed apart. The tip end **103b** of the shutter opener **103** abuts with the recess **300b** of the cartridge shutter **300a**, thereby opening the shutter **300a**.

[0172] In Figure 22A, the leading edge of the cartridge **300** reaches the locations of the projections **104e** at the rear ends of the disk holders **104**, push apart the projections **104e**, and enter holes **8h** in the side walls of the base **8**. When the opener projection **103e** reaches the switch **114**, the switch **114** is turned ON, but the holder **100** will not be driven because the switch **115** is in an OFF state (see Figure 23C).

[0173] In Figure 22B, the leading edge of the cartridge **300** pushes out the elevated portion **109b** of the holder lock **109**, thereby pivoting the holder lock **109**, so that the hook **109a** is accommodated within the holder **100**. When the cartridge **300** is completely inserted, the projections **104e** enter the notches **300c** of the cartridge **300** so as to return to their original positions, and the locking of the holder **100** is canceled (see Figure 23D).

[0174] At this time, the shutter opener **103** has pivoted to the rear of the holder **100**, and the projection **103d** is accommodated within the holder **100**.

[0175] In this state, with a further pushing or a press on the bottom on the front face of the device, the holder **100** is pulled into the device (see Figure 23E).

[0176] Once the holder **100** is pulled into the device, the cartridge lock **110** can no longer pivot outward because there are no more holes in the side wall of the base **8**. As a result, the cartridge **300** will be retained without coming loose.

[0177] Figure 24 is a plan view of the holder when a cartridge having a differently dimensioned shutter front end is mounted.

[0178] As shown in Figure 24, as opposed to a cartridge whose dimension from the positioning hole **300f** to the recess **300b** in the front end of the shutter **300a** measures **S1**, if a cartridge with a dimension **S2** which is shorter than **S1** is mounted, there is a dimensional difference of **S1 - S2**, so that the shutter opener **103** stops without pivoting to the final end. At this time, the opener plate spring **103f** abuts with the back face of the holder **100**, thereby providing energization force for the opener **103** toward the holder inlet. As a result, the shutter opener **103** is prevented from moving to the final end position due to vibration to be disengaged from the shutter **300a**.

[0179] Hereinafter, the loading operation will be described in a manner similar to the aforementioned case where no medium is mounted.

[0180] Figures 25A to D are side cross-sectional

views showing a loading operation when the cartridge **300** is mounted in the holder **100**. Figures 25A to D show chronological operation states.

[0181] When the cartridge **300** is mounted in the holder **100**, as shown in Figure 25A, the turntable **2a** is lowered because the chassis **3** is obliquely energized with respect to the base **8**, and the clamp **26** is pressed against the ceiling **25** via the clamp lever **27** owing to the energization force of the clamp pressuring spring **28**. Therefore, when the cartridge **300** is mounted in the holder **100**, the element **300d** which is exposed through the opening of the shutter **300b**, the turntable **2a**, and the clamp **26** do not contact one another. Moreover, as the shutter **300a** of the cartridge **300** is opened, the disk restraining member **29** contacts the disk **300e** to restrain the postures of the chassis **3** obliquely energized with respect to the base **8** and the disk **300e** so that they are oriented substantially parallel, thereby preventing the disk **300e** from contacting the turntable **2a** on the chassis **3**.

[0182] When a loading operation is started by pressing the eject button (not shown) as in the aforementioned case where no medium is mounted, the holder **100** is gradually accommodated into the device as shown in Figure 25B, but the disk **300e** within the cartridge **300**, the turntable **2a**, and the clamp **26** do not contact one another. Although the disk **300e** and the roller **29a** of the disk restraining member **29** contact each other, the disk **300e** is prevented from being damaged because the roller **29a** has lower hardness than the substrate material of the disk **300e** and because it rotates.

[0183] As shown in Figure 25C, once the accommodation of the holder **100** into the disk loading device is completed, the roller **29a** of the disk restraining member **29** abuts with the lower face **100d** of the holder **100** so that the disk restraining member **29** is stored into the base **8**. The rib **101a** of the holder **100** and the end **27a** of the clamp lever **27** abut with each other so that the clamp lever **27** pivots around the clamp pressuring spring **28**, the clamp **26** is lowered to a position opposing the turntable **2a**, and the clamp **26** stands by over the disk **300e**.

[0184] As shown in Figure 25D, when the pivoting of the chassis **3** is completed, the chassis **3** is oriented substantially horizontal, and the turntable **2a** on the chassis **3** is lifted so as to be engaged with the central hole of the disk **300e**. The disk **300e** is mounted upon the turntable **2a** owing to the attraction force between the clamp **26** and the turntable **2a**. The positioning hole **300f** of the cartridge **300** and the pin **16** on the chassis **3** engage with each other so that accurate positioning of the disk **300e** and the cartridge **300** upon the chassis **3** can be achieved.

[0185] At the same time, the cartridge detection circuit board **18** is lifted from the base **8** up to a predetermined position within the holder **100** owing to the restoration force of the switch circuit substrate support **17**, and the

presence/absence of a detection hole (not shown) provided on the lower face of the cartridge 300 is detected, whereby the loading operation is completed.

[0186] The expel operation of the holder 100 occurs by the opposite procedure to the above operations. When the cartridge 300 is taken out from the holder 100, it does not interfere with the shutter 300a of the cartridge 300 because of the conical shape of the roller 29a of the disk restraining member 29.

[0187] As seen from Figures 25A to D, the shutter 300a of the cartridge 300 is opened, and thereafter only the disk 300e within the cartridge 300 passes between the turntable 2a and the clamp 26, so that the distance between the turntable 2a and the clamp 26 only needs to be slightly wider than the thickness m of the disk 300e shown in Figure 3F.

[0188] Since the clamp lever 27 of the clamp 26 and the like are disposed within the bounds of the opening of the cartridge 300, the clamp lever 27 and the like only need to be provided so as not to interfere with the disk 300e within the opening of the cartridge 300, rather than the housing of the cartridge 300.

[0189] In other words, in accordance with the disk loading device according to the present example, the shutter 300a of the cartridge 300 is opened before the cartridge 300 is introduced to the rear of the holder 100. Therefore, the entire housing of the cartridge 300 does not interfere with the internal mechanism of the disk loading device. Within the bounds of the opening of the cartridge 300, only the disk 300e may interfere. As a result, the internal space of the disk loading device can be effectively utilized to the extent that it does not interfere with the disk 300e within the opening of the cartridge 300, thereby making for a thinner configuration of the device.

[0190] On the contrary, conventional devices first introduce a cartridge to the rear of the holder and then open the shutter of the cartridge. Therefore, the entire housing of the cartridge may interfere with the internal mechanism of the disk loading device, resulting in the device having a large thickness. For example, the distance between the turntable 2a and the clamp 26 is wider than the thickness M of the housing of the cartridge 300 shown in Figure 3E, resulting in the device having a large thickness.

[0191] Figures 26A to C show a thickness compensating mechanism where the thickness t of the cartridge 300 varies within its allowable error, i.e., from $t-a$ to $t+b$.

[0192] Figure 26A shows the case where the cartridge has a thickness $t-a$. If the cartridge 300 is inserted into the space within the holder 100 constituted by the holder case 101 and the holder cover 102, a space is created between the holder case 101 and the cartridge 300 because the cartridge thickness is the smallest within its allowable error range. The cartridge 300 is pressed against the holder cover 102 owing to the energization force of the cartridge energizing spring 120 provided on the holder case 101 and the energization force

of the switch circuit substrate support 17 provided on the chassis 3. The holder 100 abuts with the lower portion of the positioning pin 16 provided on the chassis 3, and the holder case 102 is spring-energized by the head unit energization spring 40 and the torsion leaf 11 for energizing the chassis 3 so as to contact the ceiling. Thus, the cartridge 300 and the holder 100 are spring-energized against the ceiling 25 as a reference point, while retaining the redundant space due to the dimensional difference within the device.

[0193] Figure 26B shows the case where the cartridge has a standard thickness t . If the cartridge 300 is inserted into the space within the holder 100, a space emerges between the holder case 101 and the cartridge 300. The cartridge 300 is pressed against the holder cover 102 owing to the energization force of the holder energizing spring 120 provided on the holder case 101, the energization force of the switch circuit substrate support 17 provided on the chassis 3, and the positioning pin 16 provided on the chassis 3. The holder 100 abuts with the lower portion of the positioning pin 16 provided on the chassis 3, and the holder case 102 is spring-energized by the head unit energization spring 40 and the torsion leaf 11 for spring-energizing the chassis 3 so as to contact the ceiling. Thus, the cartridge 300 and the holder 100 are spring-energized against the ceiling 25 as a reference point, while retaining the redundant space due to the dimensional difference within the device.

[0194] Figure 26C shows the case where the cartridge has a thickness $t+b$. If the cartridge 300 is inserted into the space within the holder 100, the space between the holder case 101 and the cartridge 300 substantially eliminated. The cartridge 300 is pressed against the holder cover 102 owing to the energization force of the holder energizing spring 120 provided on the holder case 101, the energization force of the switch circuit substrate support 17 provided on the chassis 3, and the positioning pin 16 provided on the chassis 3. The holder 100 does not abut with the lower portion of the positioning pin 16 provided on the chassis 3, and the holder case 102 is spring-energized by the head unit energization spring 40 and the torsion leaf 11 for spring energizing the chassis 3 so as to contact the ceiling. Thus, the cartridge 300 and the holder 100 are spring-energized against the ceiling 25 as a reference point.

[0195] Since the thickness difference of the cartridge is compensated for by the aforementioned constitution, it is unnecessary to incorporate a dimension for retreating the cartridge energization spring in the device's height dimension, which would conventionally have been employed. As a result, the device can be realized in a thin configuration. In any of the cases of Figures 26A to C, the predetermined positions of the disk 300e within the cartridge 300 and the optical head 7 are maintained.

(III) Loading operation when large-size disk is mounted in the holder

[0196] Next, the operation of the holder 100 in the case of inserting the large-size disk 301 in the withdrawn holder 100 will be described.

[0197] Figures 27A to C and 28 are plan views showing the operation of the holder 100 in the case of inserting the large-size disk 301 in the withdrawn holder 100. Figures 27A to C and Figure 28 show chronological operation states.

[0198] Figures 27A shows a stand-by state in which the holder 100 has been drawn out.

[0199] The disk holders 104 stand so as to be capable of retaining the large-size disk 301.

[0200] Figure 27B shows a state in which the large-size disk 301 has been inserted so as to push apart the inlet levers 107. The tip end 103b of the shutter opener 103 abuts with an end face of the large-size disk 301 and is driven away to the rear.

[0201] With reference to Figure 27C, the large-size disk 301, having overridden the inlet levers 107, enters the slits 104a of the disk holders 104, so that the inlet levers 107 and the disk holders 104 return to their original positions.

[0202] The shutter opener 103 is in a position where its tip end 103b abuts with the outer periphery of the large-size disk 301, and the projection 103d is outside the holder 100. At this time, the switch 114 is in an OFF state.

[0203] With reference to Figure 28, the large-size disk 301 is pushed slightly more inward, and the shutter opener 103 further pivots to turn the switch 114 ON. At this time, the inlet levers 107 and the junction plates 108 are in an initial state so that the switch 115 is ON. Therefore, the holder 100 begins to be drawn in.

[0204] Figure 29A is a plan view showing a state in which the large-size disk 301 is retained. Figure 29B is a side view of the disk holder 104, the inlet lever 107, and the large-size disk 301. As shown, the large-size disk 301 is retained within the slit 104a of the disk holder 104 with an interspace along the radius direction and the thickness direction.

[0205] Figures 30 show a cross section A-A in Figures 29A and B, Figure 30A showing a state during holder conveyance, and Figure 30B showing a loading completed state. In the case of horizontal installation, as shown in Figure 30A, the large-size disk 301 is on the lower end of the slits 104a during holder conveyance. Once the loading is completed so that the disk is lifted by the turntable, as shown in Figure 30B, a dimension d1 is obtained along the radial direction of the large-size disk 301, and a dimension d2 is obtained along the vertical direction of the large-size disk 301. The large-size disk 301 is driven to rotate within this interspace.

[0206] Figure 31A is a side view of the disk holder 104, and the inlet lever 107. Figure 31B is a side view showing how the large-size disk 301 is inserted. As

shown in Figures 31A and B, a groove 107a for guiding the large-size disk 301 is provided in the inlet levers 107 so as to constitute an angle α with respect to the bottom face of the holder 100. As a result, when the large-size disk 301 is inserted or taken out, the large-size disk 301 is guided in an obliquely upward direction, thereby avoiding abutment between the disk end face and the clamp section, while improving the operation feeling.

[0207] Hereinafter, the loading operation will be described in a manner similar to the aforementioned case where no medium is mounted.

[0208] Figures 32A to D are side cross-sectional views showing a loading operation in the case where the large-size disk 301 is mounted in the holder 100. Figures 32A to D show chronological operation states.

[0209] When the large-size disk 301 is mounted within the holder 100, as shown in Figure 32A, the turntable 2a is lowered because the chassis 3 is obliquely energized with respect to the base 8, and the clamp 26 is pressed against the ceiling 25 via the clamp lever 27 owing to the energization force of the clamp pressuring spring 28. Therefore, the large-size disk 301 having mounted in the holder 100 and the clamp 26 do not contact each another. Moreover, the disk restraining member 29 contacts the large-size disk 301 to restrain the postures of the chassis 3 obliquely energized with respect to the base 8 and the large-size disk 301 so that they are oriented substantially parallel, thereby preventing the large-size disk 301 from contacting the turntable 2a on the chassis 3.

[0210] When a loading operation is started by pressing the eject button (not shown) as in the aforementioned case where no medium is mounted, the holder 100 is gradually accommodated into the device as shown in Figure 32B, but the large-size disk 301, the turntable 2a, and the clamp 26 do not contact one another. Although the large-size disk 301 and the roller 29a of the disk restraining member 29 contact each other, the large-size disk 301 is prevented from being damaged because the roller 29a has lower hardness than the substrate material of the large-size disk 301 and because it rotates. At this time, as shown in Figure 18B, the projection of the shutter opener 103 leaves the hole 8e in the side face of the base 8, and the shutter opener 103 pivots in the R2 direction up to a position where it does not retain the large-size disk 301. Therefore, the shutter opener 103 and the large-size disk 301 do not engage with each other.

[0211] As shown in Figure 32C, once the accommodation of the holder 100 into the disk loading device is completed, the roller 29a of the disk restraining member 29 abuts with the lower face 100d of the holder 100 so that the disk restraining member 29 is stored into the base 8. The rib 101a of the holder 100 and the end 27a of the clamp lever 27 abut with each other so that the clamp lever 27 pivots around the clamp pressuring spring 28, the clamp 26 is lowered to a position opposing the turntable 2a, and the clamp 26 stands by over

the large-size disk 301.

[0212] As shown in Figure 32D, when the pivoting of the chassis 3 is completed, the chassis 3 is oriented substantially horizontal, and the turntable 2a on the chassis 3 is lifted so as to be engaged with the central hole of the large-size disk 301, absent the restraint on the large-size disk 301 by the shutter opener 103 or the disk holders 104. The large-size disk 301 is mounted upon the turntable 2a owing to the attraction force between the clamp 26 and the turntable 2a, whereby the loading operation is completed.

[0213] The expel operation of the holder 100 occurs by the opposite procedure to the above operations.

(IV) Medium take-out operation in an unpowered state

[0214] The loading operation in a powered state have been hitherto described. Next, an operation for taking out a medium which is stored in the disk loading device during an unpowered state will be described.

[0215] Figures 33A, B through Figures 34A, B are plan views showing an operation of taking out the large-size disk 301 stored in the disk loading device during an unpowered state. Figures 35A to D are side cross-sectional views thereof.

[0216] Figures 36A to D are side cross-sectional views showing how the claw 14a of the forced ejection lever 14 is engaged with the engagement section 100c of the holder 100 responsive to the insertion of an eject pin 24.

[0217] As shown in Figure 33A, the eject pin 24 is inserted into the disk loading device through the forced ejection hole 21a in the panel 21. The eject pin 24 engages with the end portion 14a of the forced ejection lever 14. The forced ejection lever 14 is mounted between the slide rack 13 and the base 8 in X1-X2 direction, and slightly energized in the X1 direction by the forced ejection spring 15. The description will illustrate a case where the optical head 7 is located at the innermost portion of the large-size disk 301, which portion is the closest to the turntable 2a. In this state, as shown in Figure 35A, the chassis 3 is substantially horizontal. The forced ejection spring 15 is mounted as shown in Figure 36A; the engagement claw 14a of the forced ejection spring lever 14 and the engagement section 100c of the holder 100 are detached from each other.

[0218] As shown in Figure 33B, when the eject pin 24 is further inserted into the disk loading device (in the X2 direction) while compressing the ejection spring 15, the forced ejection lever 14 is pushed in the X2 direction, and a rib 14b of the forced ejection lever 14 abuts with an end portion 4a of the head transfer lever 4, which is mounted to the chassis 3 so as to be slidable in the X1-X2 direction. Eventually, an end portion 7a of the optical head 7 abuts with an end portion 4b of the head transfer lever 4, so as to be transferred in the X2 direction. In this state, as shown in Figure 35B, the end face 13e of the

slide rack 13 is yet to abut with and the end face 14c of the forced ejection lever. Therefore, only the optical head 7 moves in the X2 direction, and the chassis 3 maintains its substantially horizontal state.

[0219] As shown in Figure 36B, the forced ejection lever 15 is compressed so as to store force for expelling the holder, and deforms the holder engagement claw 14a of the forced ejection lever 14 in a direction of approaching the holder 100 because the holder engagement claw 14a of the forced ejection lever 14 has an aperture which allows deformation only in the direction of approaching the engagement section 100c of the holder.

[0220] As the forced ejection pin 24 is further inserted, as shown in Figure 34A, the optical head 7 is transferred to the outermost periphery of the large-size disk 301, and the claw 14a of the forced ejection lever 14 engages with the engagement section 100c of the holder 100. At the same time, the end face 13e of the slide rack 13 and the end face 14c of the forced ejection lever abut with each other. Responsive to the travel of the slide rack 13 in the X2 direction, the elevation cam 10 pivots in the R2 direction, so that the chassis 3 pivots from the substantially horizontal state to the oblique state. In this state, as shown in Figure 35C, the completion of the tilting of the chassis 3 may be designed so as to occur after the optical head 7 has been retracted to the outermost periphery; as a result, the lower face of the optical head 7 will not stick out from the lower face of the base 8, so that the disk loading device can attain a thin configuration.

[0221] As shown in Figures 34A and 36C, the insertion stroke of the forced ejection pin 24 may be designed so as to come to an end where the claw 14a of the forced ejection lever 14 engages with the engagement section 100c of the holder 100, so that the insertion of the forced ejection pin 24 in the X2 direction is stopped. As a result, the holder 100 begins traveling in the X1 direction owing to the restoration force of the compressed forced ejection spring 15.

[0222] By drawing out the forced ejection pin 24 from the disk loading device in this state, as shown in Figure 34B, the engagement between the rectangular hole 101b of the holder 100 and boss 12b of the clutch 12 is canceled responsive to the travel of the holder 100, so that the holder 100 becomes capable of moving in the X1 direction, and the claw 12d of the clutch 12 engages with the rib 8c of the base 8 so as to confine the slide rack 13. In this state, as shown in Figure 35D, the holder 100 is slightly withdrawn from the disk loading device, so that the large-size disk 301 stored in the holder 100 can be taken out by manually drawing out the holder section in the X1 direction up to a completely expelled holder position. Moreover, by pulling out the forced ejection pin 24, as shown in Figure 36D, the holder 100 is ejected outside the device owing to the energization force of the forced ejection spring 15. When the holder 100 has been ejected to a predetermined position, the

engagement between the claw 14a of the forced ejection lever 14 with the engagement section 100c of the holder 100 due to the forced ejection spring 15 is canceled.

[0223] The above description illustrates the case where the optical head 7 is at the innermost position of the large-size disk 301. However, it will be appreciated that, also in the case where the optical head 7 stands by in any position, the optical head 7 is transferred to the outermost position before the tilting operation of the chassis 3 is completed.

[0224] Although the take-out operation for the large-size disk 301 in an unpowered state is described above, a cartridge 300 and a small-size disk 302 can be taken out in a similar manner.

[0225] When the device is powered again, the central processing unit (MPU) 34 may ensure that the holder 100 is accommodated and the optical head 7 is moved to the innermost position by the feed motor 5 after completion of the loading operation. As a result, the head transfer lever 4 is moved to a predetermined position at the innermost periphery by the optical head 7, returning to the initial state shown in Figure 33A, so that it will not interfere with the operation of the optical head 7.

(V) Loading operation in the case where an adapter is mounted in the holder

[0226] Figure 37 is a perspective view showing a first example of an adapter according to the present invention.

[0227] With reference to Figure 37, reference numeral 801 denotes an adapter having the same width, length, thickness dimensions and the same positions and dimensions of alignment holes 811 and 812 as those of the cartridge 300. The adapter can be mounted in a disk loading device which is compatible with the disk cartridge 300. Reference numeral 813 denotes grips for retention by an automatic exchanger, and 814 denotes a notched portion, which have configurations and dimensions that are also compatible with the cartridge 300. Thus, it allows for use with an automatic exchanger, and inadvertent insertion is prevented based on the notched portions.

[0228] Reference numerals 815 and 816 denote openings for allowing the entrance of the optical head 7 and the turntable 2, respectively.

[0229] Reference numeral 817 denotes a cylindrical face which is concentric with the small-size disk 302 and which is slightly larger than the outer diameter of the small-size disk 302 as well as a vertical face which is parallel to the direction in which the small-size disk 302 is to be inserted. Reference numeral 818 denotes a projection piece for restraining the lower face of the small-size disk 302; and 819 denotes a projection piece for restraining the upper face of the small-size disk 302. Thus, a retention section is constructed for retaining the small-size disk 302 while leaving some interspace with

its outer periphery and thickness.

[0230] Reference numeral 820 denotes a disk insertion section, constituted by a conical face provided at the trailing end on a central line along the direction in which the adapter body is inserted into the disk loading device, such that the ridge between the upper face of the adapter and the conical face is larger than the outer contour of the small-size disk 302. As shown in Figure 39A, the small-size disk 302 is stored into the adapter 801 while being tilted.

[0231] Reference numeral 821 denotes a pair of disk guiding members as cantilever plates which are perpendicular to the disk surface of the small-size disk 302. The intersection a2 between the lever extension of the disk guiding members 821 and the central line along the insertion direction of the adapter is located forward with respect to a center a1 of the disk retention position along the insertion direction, so that, when the small-size disk 302 is inserted, the small-size disk 302 is inserted while pushing apart the disk guiding members 821. After the insertion of the small-size disk 302 is completed, the small-size disk 302 is retained with an interspace between the tip ends of the disk guiding members 821 and the outer periphery of the small-size disk 302. A projection piece 821a for restraining the upper face of the small-size disk 302 is provided.

[0232] Figures 39A, B, and C show the manner in which the small-size disk 302 is inserted. Figure 39A shows a state in which the outer periphery of the small-size disk 302 has contacted with the tip ends of the disk guiding members 821. As a force F is applied along the insertion direction, a large component force f exists in a direction to deflect the cantilevers. Therefore, the disk can be lightly inserted. Figure 39B shows a state in which the small-size disk 302 has been inserted so that the guiding members have been pushed all the way apart. Figure 39C shows a state in which the small-size disk 302 is inserted even deeper so that the small-size disk 302 has been accommodated in the retention position. Once the small-size disk 302 has been accommodated in the retention position, even if a force F1 acts in a direction for taking out the small-size disk 302, the force f1 acting on the levers will act in a direction to compress the levers so that a very little component force exists in the deflecting direction. Accordingly, the cantilevers hardly deflect; if at all, the cantilevers will deflect in a direction tangent to the circumference of the small-size disk 302, so that very minute deformation results along the radius direction of the small-size disk 302. Thus, the positional accuracy of the small-size disk 302 is secured.

[0233] In the case of taking out the small-size disk 302, the intersection a2 between the extensions of the free ends of the disk guiding members in the form of cantilevers and the insertion central line of the insertion adapter for the small-size disk 302 is located slightly forward with respect to the center a1 of the disk retention position along the insertion direction. Therefore, the

small-size disk 302 can be taken out by applying a slightly greater force F1.

[0234] In other words, the disk guiding members 821 deflect so that the small-size disk 302 can be lightly inserted, whereas the deflection of the disk guiding members 821 provide repellent force when the small-size disk 302 is taken out. Thus, the small-size disk 302 can be put in or taken out with a good feel.

[0235] Figure 38 is a perspective view showing an adapter according to a second example of the present invention. In Figure 38, 811 to 819 are the same as in the adapter of Figure 37, and the descriptions thereof are omitted.

[0236] Reference numeral 820 denotes a disk insertion section for the small-size disk 302, constituted by a plane that is parallel to the adapter plane, and provided at the trailing end on a central line along the direction in which the adapter body is inserted into the disk loading device. In this case, the small-size disk 302 is stored in parallel to the plane of the adapter 801.

[0237] The adapter 801 has a cut-away structure in which rib structures are left. Various designs may be incorporated therein.

[0238] Figures 40A to C show a manner in which the adapter 801 is used. Figure 40A shows a state in which the holder 100 protrudes from the disk loading device body, ready for insertion of a medium. The adapter 801 is inserted in the same manner as the cartridge 300.

[0239] Figure 40B shows a state in which the mounting of the adapter 801 into the holder 100 has been completed. In this state, the small-size disk 302 can be mounted into or detached from the adapter 801 in the same manner as in Figures 39A to C.

[0240] Figure 40C shows a state in which, after the insertion of the small-size disk 302 has been completed, the holder 100 is drawn into the device body, whereby the loading operation is completed.

INDUSTRIAL APPLICABILITY

[0241] As described above, in accordance with the disk loading device of the present invention, the operation of opening a shutter is completed by a shutter opening/closing means which is provided at the rear end of a holder before a leading edge end of a cartridge passes over a clamp section. Therefore, the shutter is already in an open state when the leading edge end of the cartridge passes over the clamp section. As a result, a disk motor and the retreated position of a clasper can be located adjacent to each other, so that during a clamp operation, the amount of relative movement between the disk motor, the clasper, and the cartridge can be small. Since the entire thickness of the cartridge does not need to be retreated into the clamp section, a disk loading device in a thin configuration can be realized.

[0242] In one embodiment, a tip end of an arm from the holder for the cartridge does not interfere with a retention section of a rotation driving means. Therefore,

the interspace between a turntable, which is the retention section of the rotation driving means, and the clasper can be reduced.

[0243] In one embodiment, the arm pivots as a result of a portion of the arm being caught by a guide of the holder and moving.

[0244] In one embodiment, a shutter opening operation is securely performed without requiring the arm to move to the final end of the travel path of the arm and without allowing the arm to be disengaged from the shutter of the cartridge.

[0245] In one embodiment, the cartridge is interposed between a pair of interposition members, and a bare disk is retained in slits in retention sections of the respective interposition members.

[0246] In one embodiment, a pair of inlet levers are pushed apart by the cartridge when the cartridge is inserted. As a result, the tip ends of the pair of disk holders are spread, thereby allowing the cartridge to pass between the tip ends of the disk holders.

[0247] In one embodiment, the state of the pair of interposition members changes when the cartridge is retained, the state being detected by a second detection means. Based on the detection outputs from first and second detection means, it is possible to determine whether a cartridge or a disk by itself has been inserted into the holder.

[0248] In accordance with an adapter for a disk according to the present invention, disks having different diameters can be used, and exchange of disks is possible while the adapter is mounted in the holder.

[0249] In accordance with a disk loading device of the present invention, a mechanism for locking the holder to a guide responsive to the insertion of a cartridge is constructed. During the insertion of a cartridge, the holder can be secured by preventing the holder from being pushed into the guide because of, for example, a load due to the operation of opening the shutter of the cartridge. Thus, it is possible to securely mount the cartridge in the holder.

[0250] In one embodiment, the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof, and the locking member is provided on the pair of interposition members.

[0251] In accordance with a disk loading device of the present invention, a mechanism for locking the holder to a guide responsive to the insertion of a cartridge is constructed. During the insertion of a cartridge, the holder can be secured by preventing the holder from being pushed into the guide because of, for example, a load due to the operation of opening the shutter of the cartridge. Thus, it is possible to securely mount the cartridge in the holder. Furthermore, when the cartridge is mounted in the holder, the locking member is snugly received by a recessed section of the cartridge, so that it is possible to accurately position the cartridge within the holder. At the same time, since the locking member is disengaged from the guide, it is possible to securely

load the cartridge, along with the holder, after the cartridge is accurately positioned within the holder.

[0252] In one embodiment, the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof, and the locking member is provided on the pair of interposition members.

[0253] In accordance with a disk loading device of the present invention, a forced ejection function for forcing the cartridge to be ejected is realized. In a normal operation which does not utilize the forced ejection function, an elastic member is not caught by the cartridge. When the forced ejection function is utilized, the elastic member is deformed by the operation section, so that the deformed elastic member is caught by the cartridge. The cartridge which is caught by the elastic member is ejected from the holder owing to the elastic force of the elastic member restoring its original shape.

[0254] In accordance with the aforementioned constitution, a disk loading device can be realized in a thin configuration.

[0255] In accordance with a disk loading device of the present invention, at least a portion of a mechanism for activating the retention section of the rotation driving section is disposed in a range overlapping with an opening of the cartridge. The thickness of the opening of the cartridge is thinner than the entire thickness of the cartridge. As a result, by disposing at least a portion of the retention section of the rotation driving section in the opening of the cartridge, the retention section can be located closer to the disk. As a result, a disk loading device can be realized in a thin configuration.

Claims

1. A disk loading device comprising:

a holder for detachably retaining a cartridge;
transfer means for transferring the holder;
shutter opening/closing means for opening a shutter of the cartridge when the cartridge is inserted into the holder; and
rotation driving means having a retention section for retaining a disk in the vicinity of a center thereof, the disk being within the cartridge having been transferred to a predetermined position by the transfer means, wherein the rotation driving means rotates the disk retained by the retention section,
wherein, during transfer by the transfer means, an opening of the cartridge previously closed by the shutter of the cartridge passes where the retention section of the rotation driving means is with the shutter of the cartridge being opened by the shutter opening/closing means.

2. A disk loading device according to claim 1, wherein the shutter opening/closing means is an arm pivotably supported by the holder such that the shutter is

opened by a tip end of the arm being caught by the shutter of the cartridge when the cartridge is inserted into the holder, and

wherein during the transfer by the transfer means, the arm is pivoted so that the tip end of the arm moves in a manner to avoid the retention section of the rotation driving means.

3. A disk loading device according to claim 2, wherein during the transfer by the transfer means, the arm pivots as a result of a portion of the arm being caught by a guide of the holder and moving.

4. A disk loading device according to claim 2, comprising an energization means for energizing the tip end of the arm toward the shutter of the cartridge while the cartridge is retained by the holder and the tip end of the arm is caught by the shutter of the cartridge.

5. A disk loading device comprising a holder for retaining a cartridge accommodating a disk or a disk by itself,

wherein the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof; and

wherein the pair of interposition members include an inlet section which is wider than a width of the cartridge, and a retention section for interposing the cartridge at the opposite sides thereof, the cartridge having been inserted through the inlet section, wherein at least the retention section includes slits into which opposite ends of the disk by itself are respectively inserted.

6. A disk loading device according to claim 5, wherein the pair of interposition members comprise a pair of inlet levers and a pair of disk holders,

wherein tip ends of the pair of inlet levers are supported so that the tip ends of the pair of inlet levers are wider than a width of the cartridge;

wherein rear ends of the pair of inlet levers and tip ends of the pair of disk holders are mutually supported so as to elastically retain the respective disk holders; and

wherein at least the pair of disk holders include slits into which opposite ends of the disk by itself are respectively inserted.

7. A disk loading device according to claim 5 comprising:

first detection means for detecting insertion of either the cartridge or the disk by itself into the holder; and

second detection means for detecting a state of the pair of interposing members.

8. An adapter for detachably retaining a disk by itself, the adapter comprising:

a recessed section for snugly receiving the disk;
 an introduction section for introducing the disk into the recessed section; and
 an elastic section provided between the recessed section and the introduction section, the elastic section moving by being pushed by a rim of the disk toward outside of the recessed section when the disk is introduced from the introduction section to the recessed section, and the elastic section returning to a vicinity of the rim of the disk when the disk has been snugly received by the recessed section, wherein an opening is provided for allowing a central portion of the disk having been snugly received by the recessed section to be externally retained and for externally performing recording or reproduction to the disk.

9. A disk loading device comprising:

a holder for detachably retaining a cartridge;
 and
 a guide for movably supporting the holder, wherein the holder includes a locking member, and wherein the locking member protrudes from the holder so as to be caught by the guide responsive to the cartridge having been inserted into the holder.

10. A disk loading device according to claim 9, wherein the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof, and

the locking member is provided on the pair of interposition members.

11. A disk loading device comprising:

a holder for detachably retaining a cartridge;
 and
 a guide for movably supporting the holder, wherein the holder includes a locking member, and wherein the locking member protrudes from the holder so as to be caught by the guide responsive to the cartridge having been inserted into the holder, and, when the cartridge is mounted in the holder, the locking member is snugly received by the recessed section of the cartridge so as to be retreated into the holder and disengaged from the guide.

12. A disk loading device according to claim 11, wherein the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof, and

wherein the locking member is provided on the pair of interposition members.

13. A disk loading device comprising:

a holder for detachably retaining a cartridge;
 an elastic member provided on the holder, the elastic member being disposed in a vicinity of the cartridge retained by the holder; and
 an operation section for deforming the elastic member so that the deformed elastic member is caught by the cartridge, wherein the cartridge caught by the elastic member is ejected from the holder owing to elastic force of the elastic member restoring its original shape.

14. A disk loading device comprising:

a holder for detachably retaining a cartridge;
 shutter opening/closing means for opening a shutter of the cartridge retained by the holder; and
 rotation driving means having a retention section for retaining a disk in the vicinity of a center thereof, the disk being within the cartridge whose shutter is opened, wherein the rotation driving means rotates the disk retained by the retention section, wherein, at least a portion of a mechanism for activating the retention section of the rotation driving means is disposed in a range overlapping with an opening of the cartridge previously closed by the shutter.

Amended claims under Art.19.1 PCT

1. (Amended) A disk loading device comprising:

a holder for detachably retaining a cartridge;
 transfer means for moving the holder in or out through an opening at a front of a drive apparatus;
 a guide for movably supporting the holder;
 a retention section for retaining a disk in the vicinity of a center thereof, the disk being within the cartridge having been transferred to a predetermined position by the transfer means;
 rotation means for rotating the disk retained by the retention section;
 shutter opening/closing means in the holder, having an arm which is rotatably supported and energized toward an inlet side by an elastic element, the arm having a tip end which abuts with

the cartridge and another end having a short projection; and

a notch provided in the guide for engaging with the short projection on the arm when the holder has moved out to a cartridge insertion position located at a most proximal end,

wherein, when the cartridge is inserted into the holder, the tip end of the arm abuts with a shutter of the cartridge so as to open the shutter, the cartridge thereafter being drawn in by the transfer means, and

wherein, when the holder is drawn in by the transfer means without the cartridge being inserted, the short projection on the other end of the arm is pushed by a side face of the guide so as to go out of the notch in the guide, causing the arm to be pivoted so that the tip end of the arm moves in a manner to avoid the retention section of the rotation driving means.

2. (Deleted)

3. (Deleted)

4. (Deleted)

5. A disk loading device comprising a holder for retaining a cartridge accommodating a disk or a disk by itself,

wherein the holder includes a pair of interposition members for interposing the cartridge at opposite sides thereof; and

wherein the pair of interposition members include an inlet section which is wider than a width of the cartridge, and a retention section for interposing the cartridge at the opposite sides thereof, the cartridge having been inserted through the inlet section, wherein at least the retention section includes slits into which opposite ends of the disk by itself are respectively inserted.

6. A disk loading device according to claim 5, wherein the pair of interposition members comprise a pair of inlet levers and a pair of disk holders,

wherein tip ends of the pair of inlet levers are supported so that the tip ends of the pair of inlet levers are wider than a width of the cartridge;

wherein rear ends of the pair of inlet levers and tip ends of the pair of disk holders are mutually supported so as to elastically retain the respective disk holders; and

wherein at least the pair of disk holders include slits into which opposite ends of the disk by itself are respectively inserted.

7. A disk loading device according to claim 5 comprising:

first detection means for detecting insertion of either the cartridge or the disk by itself into the holder; and

second detection means for detecting a state of the pair of interposing members.

8. An adapter for detachably retaining a disk by itself, the adapter comprising:

a recessed section for snugly receiving the disk;

an introduction section for introducing the disk into the recessed section; and

an elastic section provided between the recessed section and the introduction section, the elastic section moving by being pushed by a rim of the disk toward outside of the recessed section when the disk is introduced from the introduction section to the recessed section, and the elastic section returning to a vicinity of the rim of the disk when the disk has been snugly received by the recessed section, wherein an opening is provided for allowing a central portion of the disk having been snugly received by the recessed section to be externally retained and for externally performing recording or reproduction to the disk.

9. (Amended) A disk loading device comprising:

a holder for detachably retaining a cartridge; and

an inlet lever, a junction plate, and a locking member disposed in the vicinity of an opening of the holder,

wherein the inlet lever has a rotation axis outside a space in which the cartridge passes, and is slightly elastically energized toward a center of the holder,

wherein the junction plate has a rotation axis outside the space in which the cartridge passes, and pivots concurrently with the pivoting of the inlet lever, and

wherein the locking member is mounted so as to be capable of pivoting relative to the junction plate, the locking member having a hook section which protrudes from the holder and an abutting section which abuts with the cartridge.

10. (Deleted)

11. (Deleted)

12. (Deleted)

13. (Amended) A disk loading device comprising:

a holder for detachably retaining a cartridge

and capable of being moved in and out;
an elastic member provided in the vicinity of the
holder; and
an operation section for deforming the elastic
member so that the deformed elastic member 5
is caught by the holder,
wherein the holder caught by the elastic mem-
ber is ejected owing to elastic force of the elas-
tic member restoring its original shape.

10

14. A disk loading device comprising:

a holder for detachably retaining a cartridge;
shutter opening/closing means for opening a
shutter of the cartridge retained by the holder; 15
and
rotation driving means having a retention sec-
tion for retaining a disk in the vicinity of a center
thereof, the disk being within the cartridge
whose shutter is opened, wherein the rotation 20
driving means rotates the disk retained by the
retention section,
wherein, at least a portion of a mechanism for
activating the retention section of the rotation
driving section is disposed in a range overlap- 25
ping with an opening of the cartridge previously
closed by the shutter.

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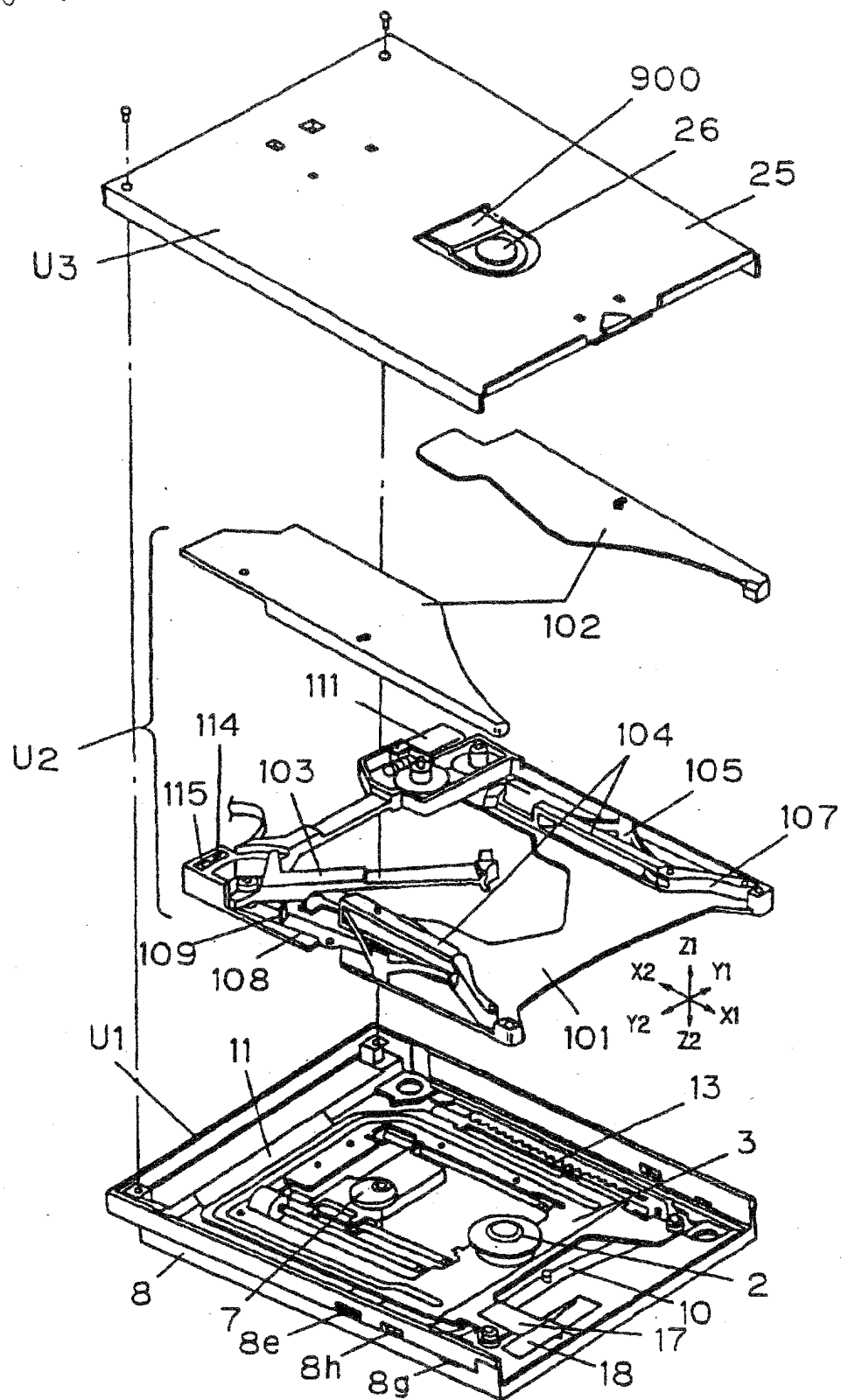
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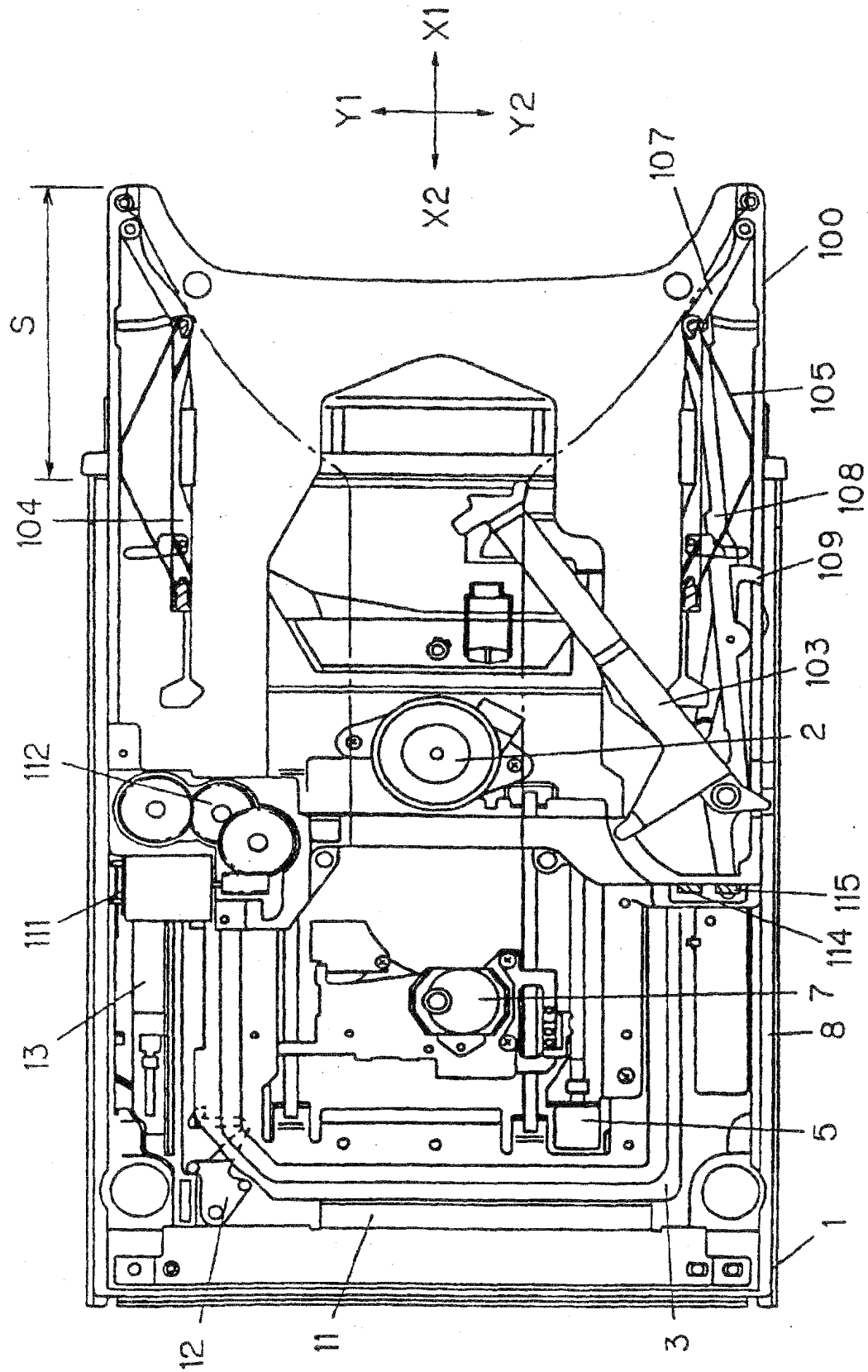
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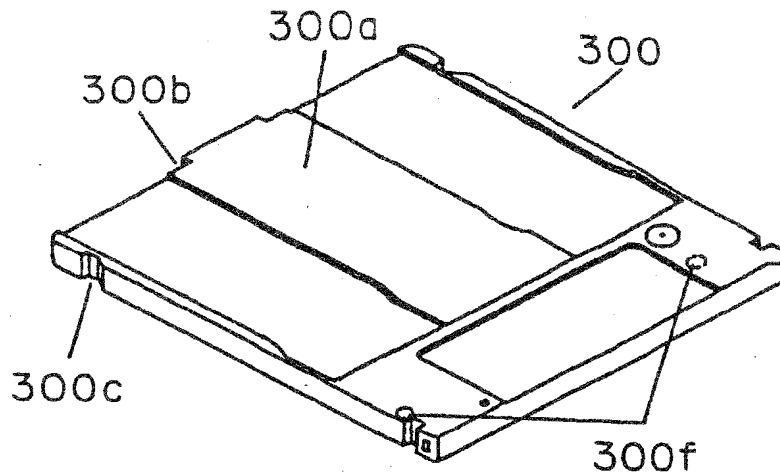
{ Fig 1 }



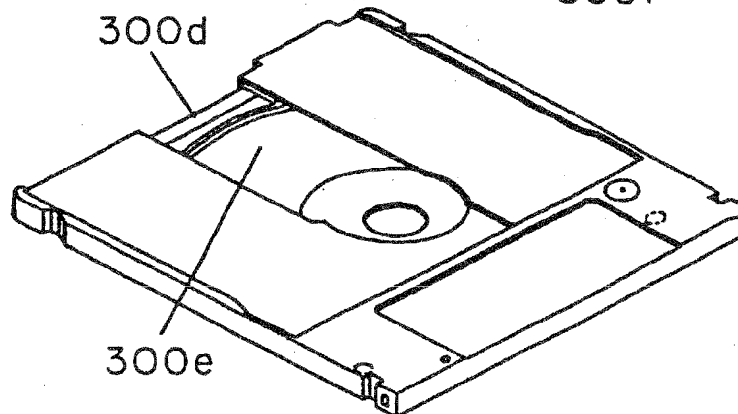
{ Fig. 2 }



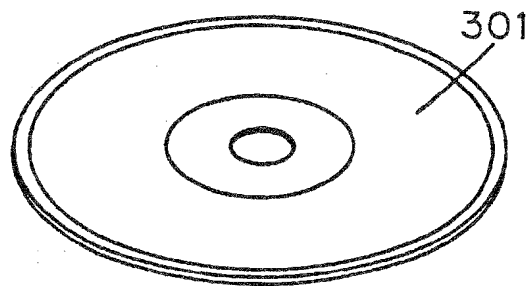
{Fig. 3A}



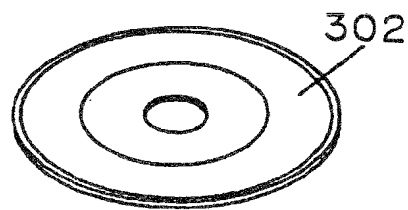
{Fig. 3B}



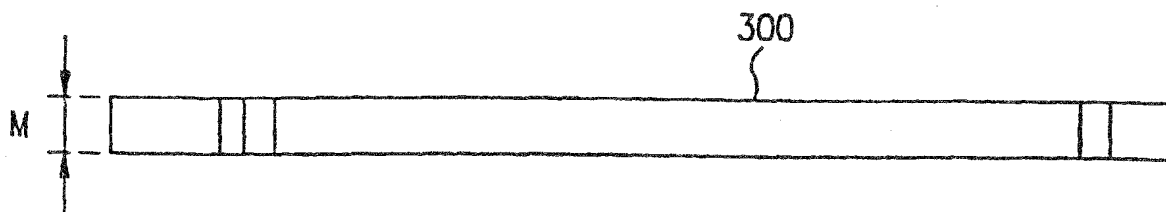
{Fig. 3C}



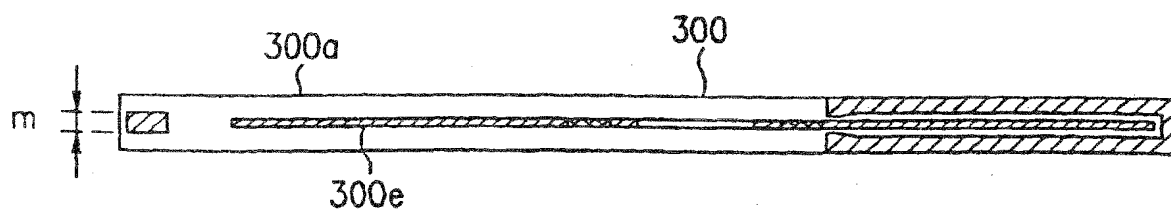
{Fig. 3D}



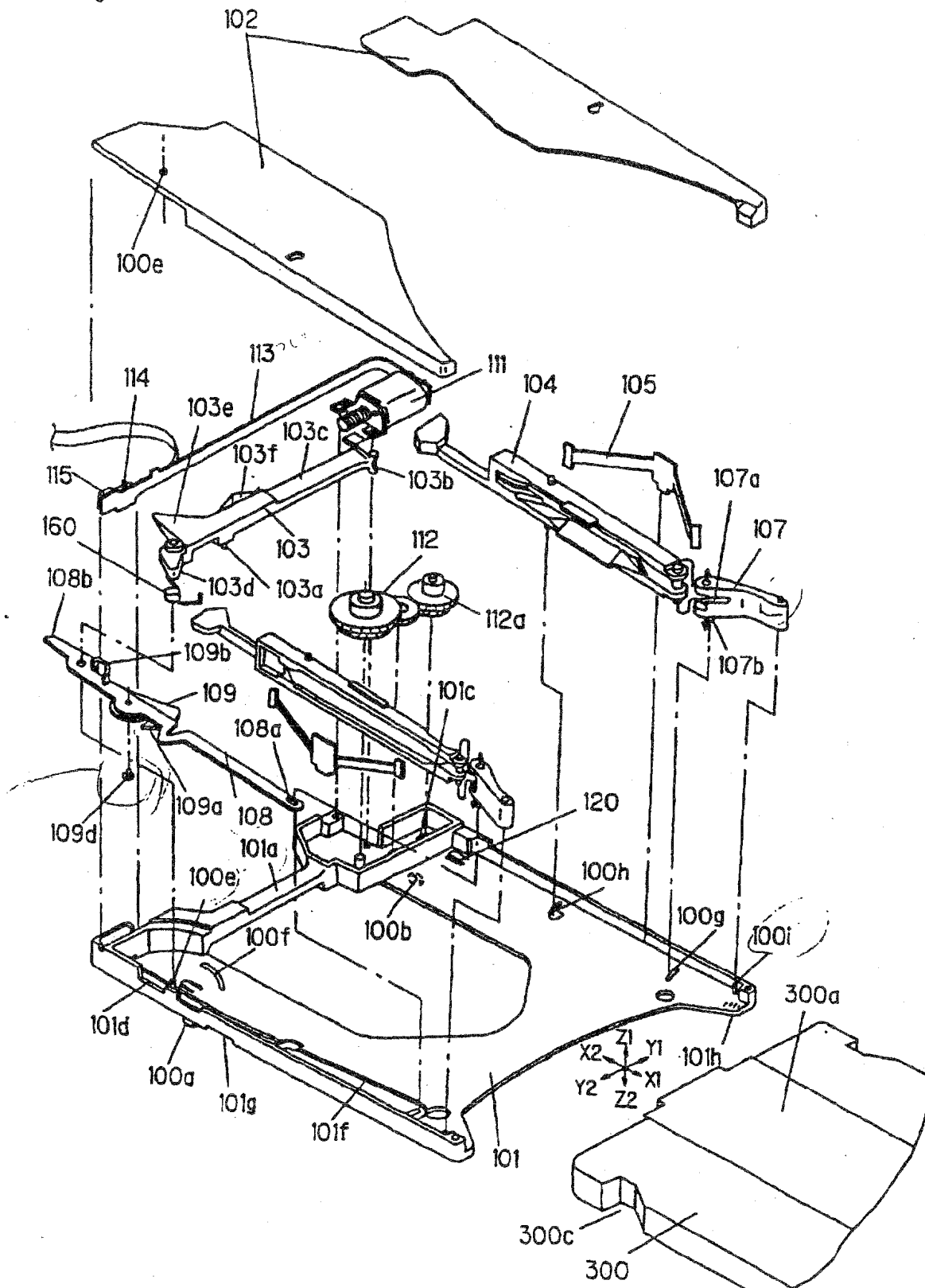
{ Fig. 3E }



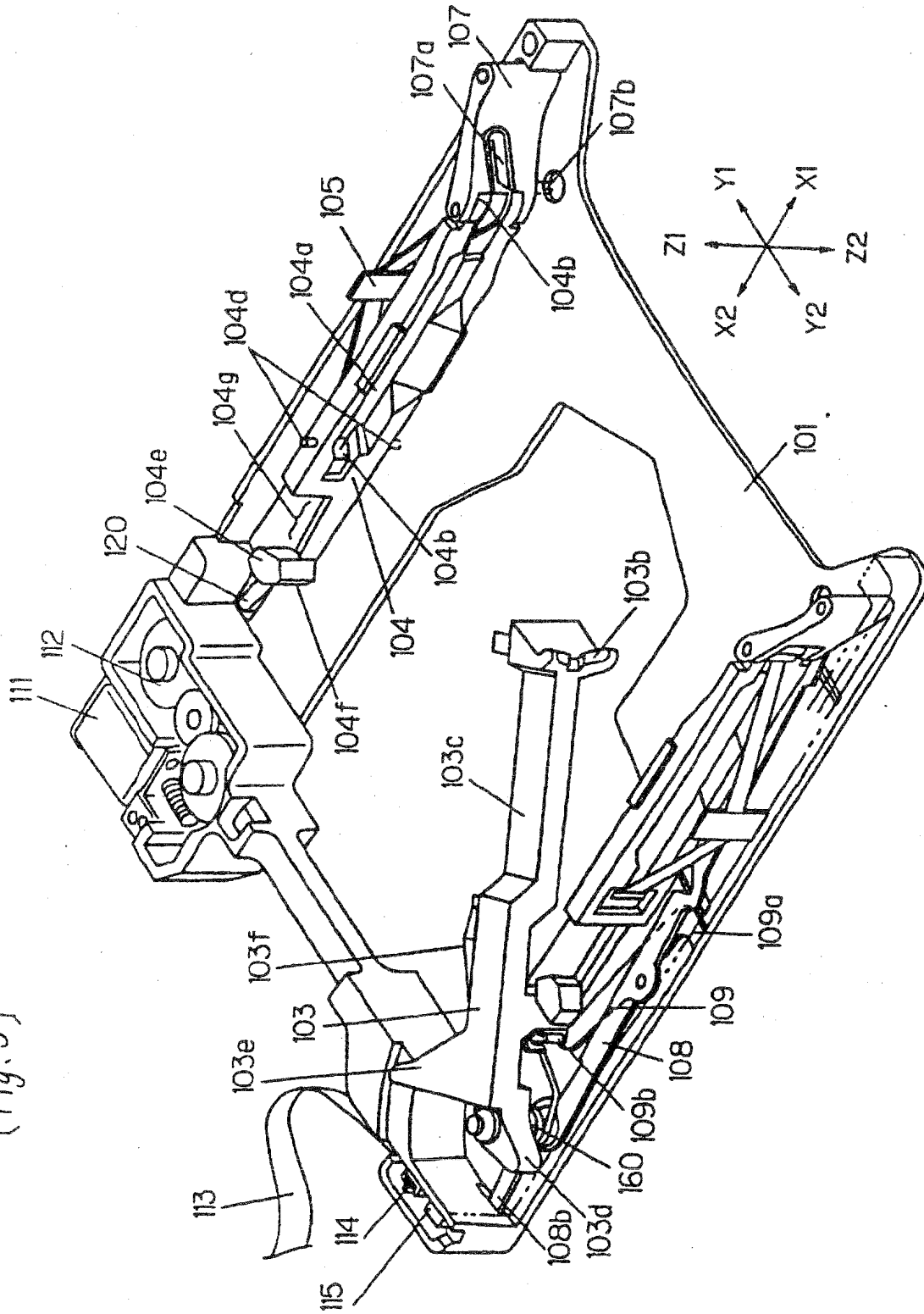
{ Fig. 3F }



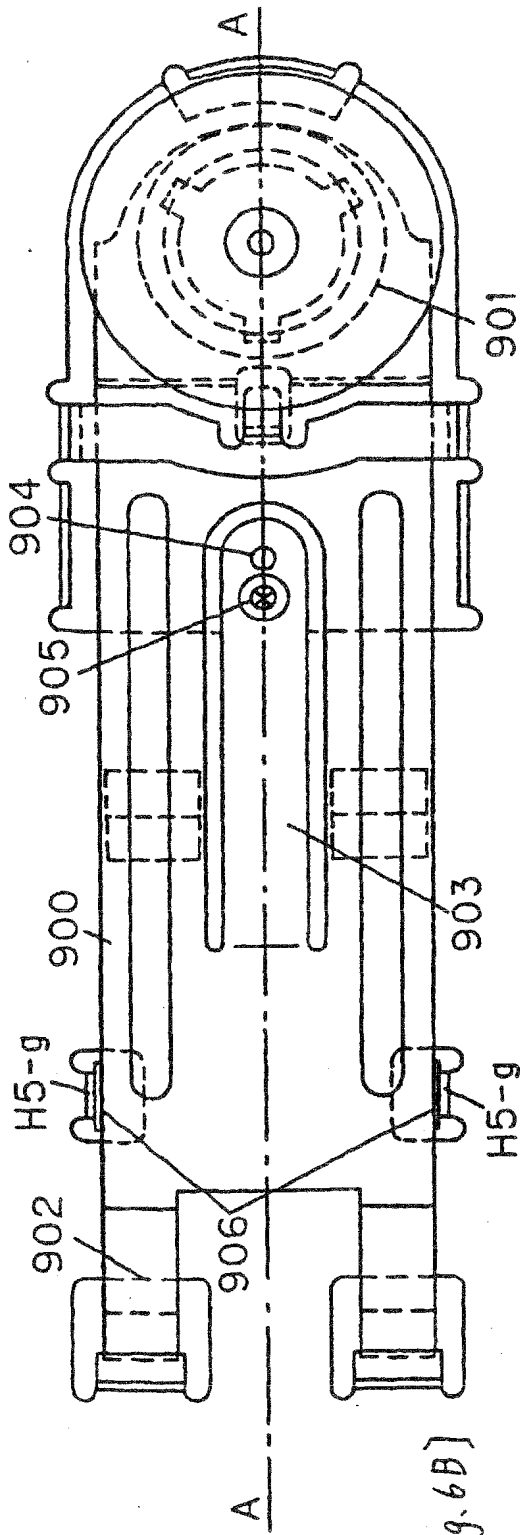
[Fig. 4]



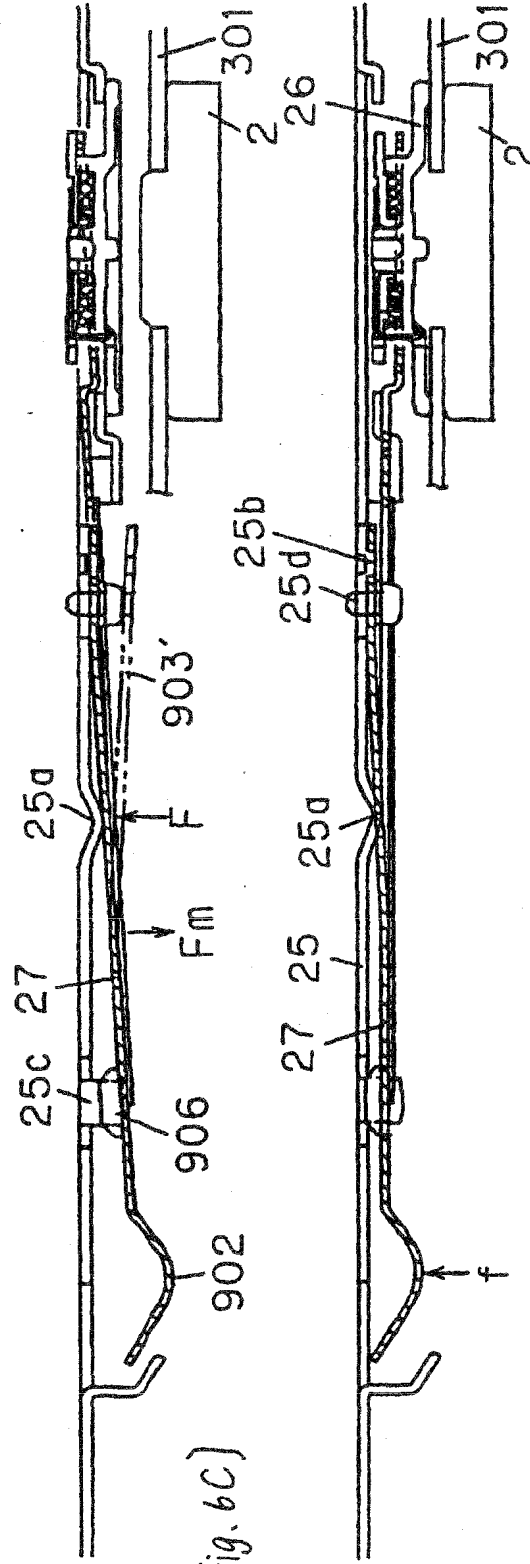
(Fig. 5)



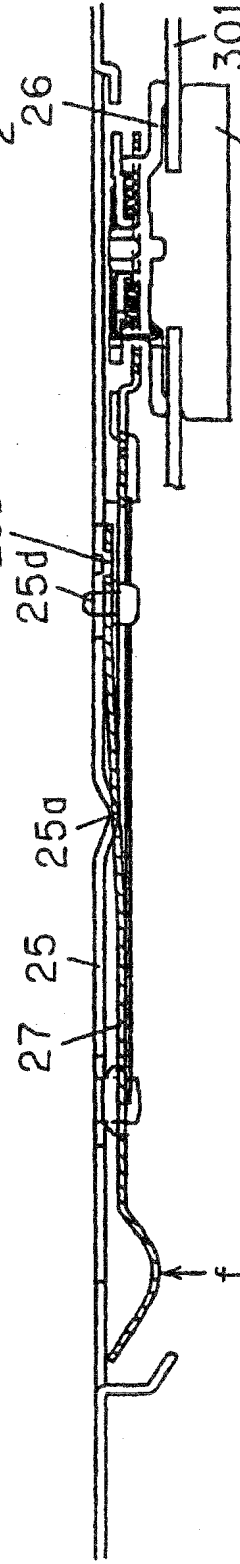
{ Fig. 6A }



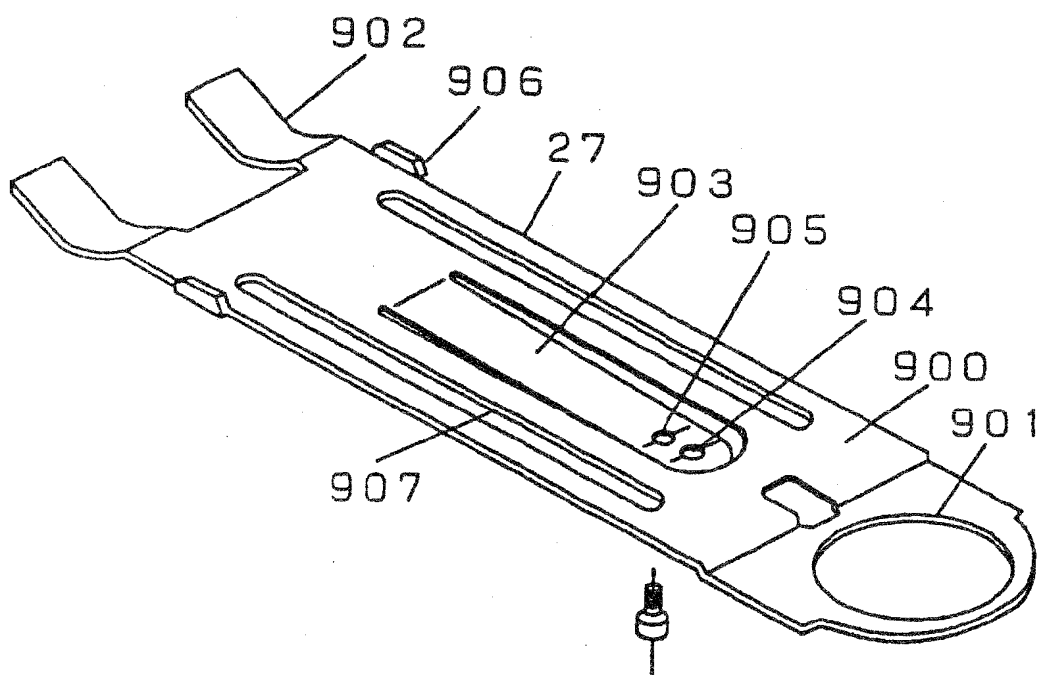
{ Fig. 6B }



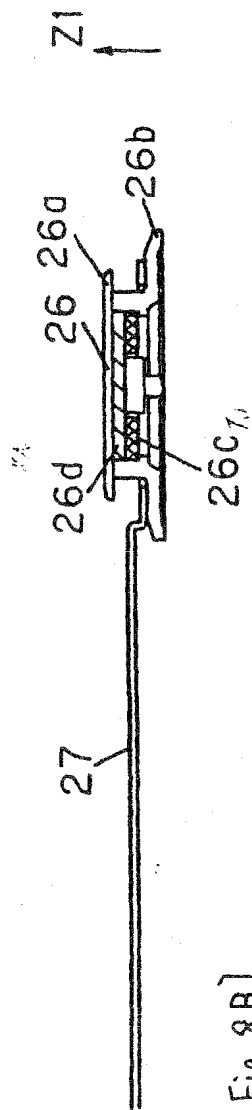
{ Fig. 6C }



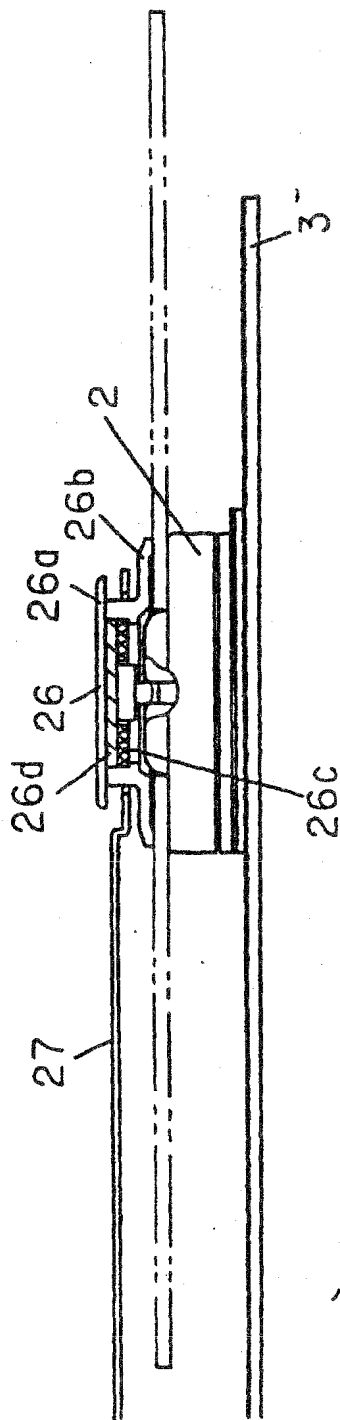
{ Fig. 7 }



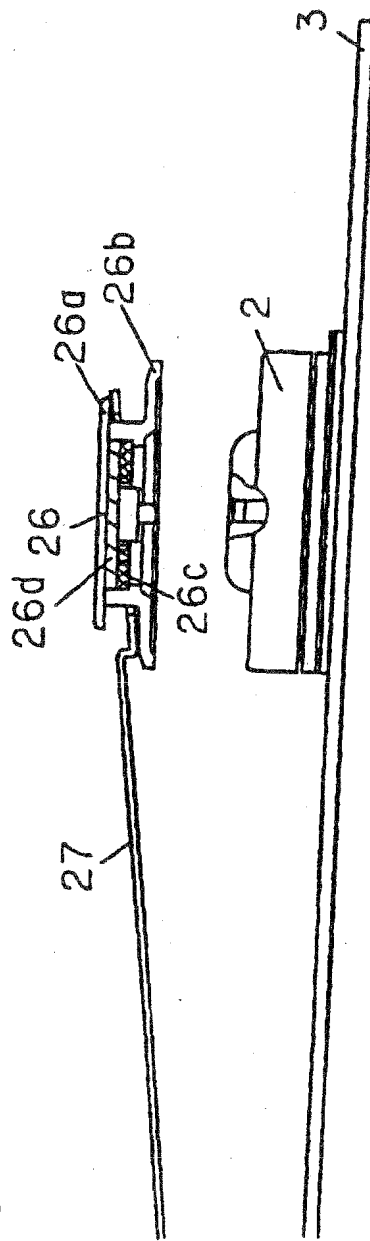
{Fig. 8A}



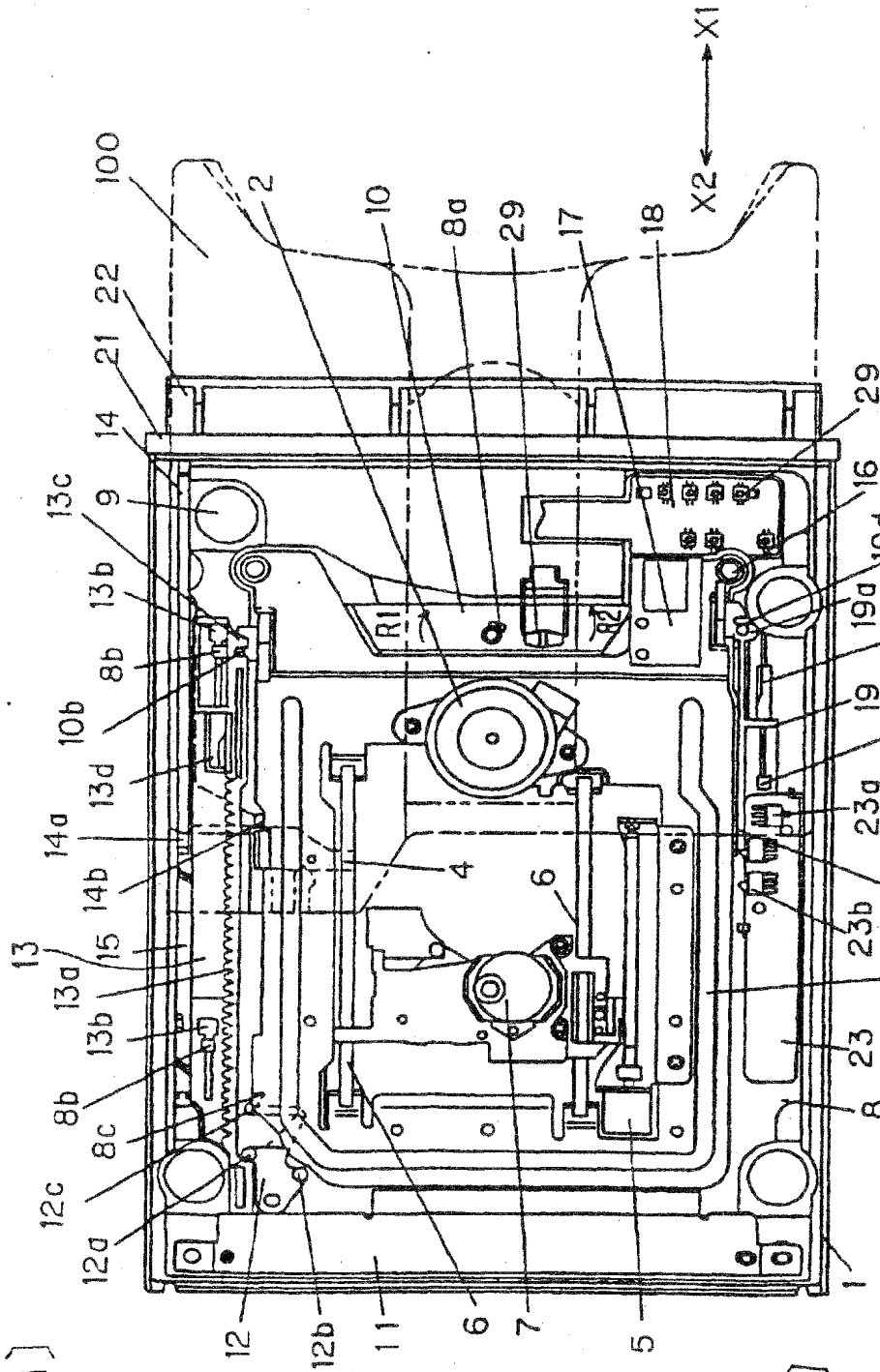
{Fig. 8B}



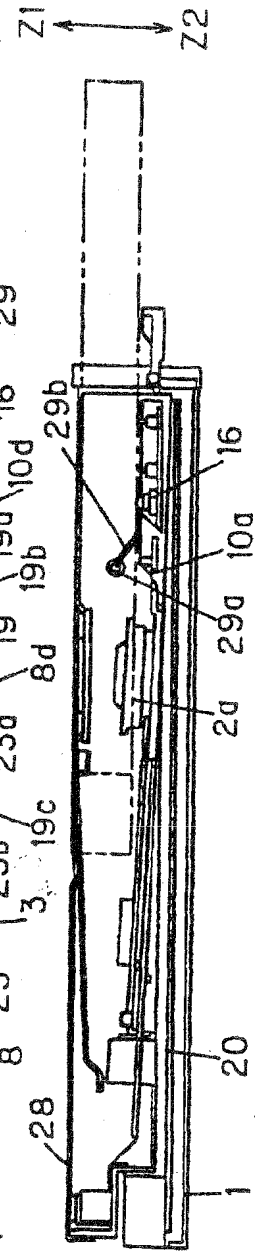
{Fig. 8C}



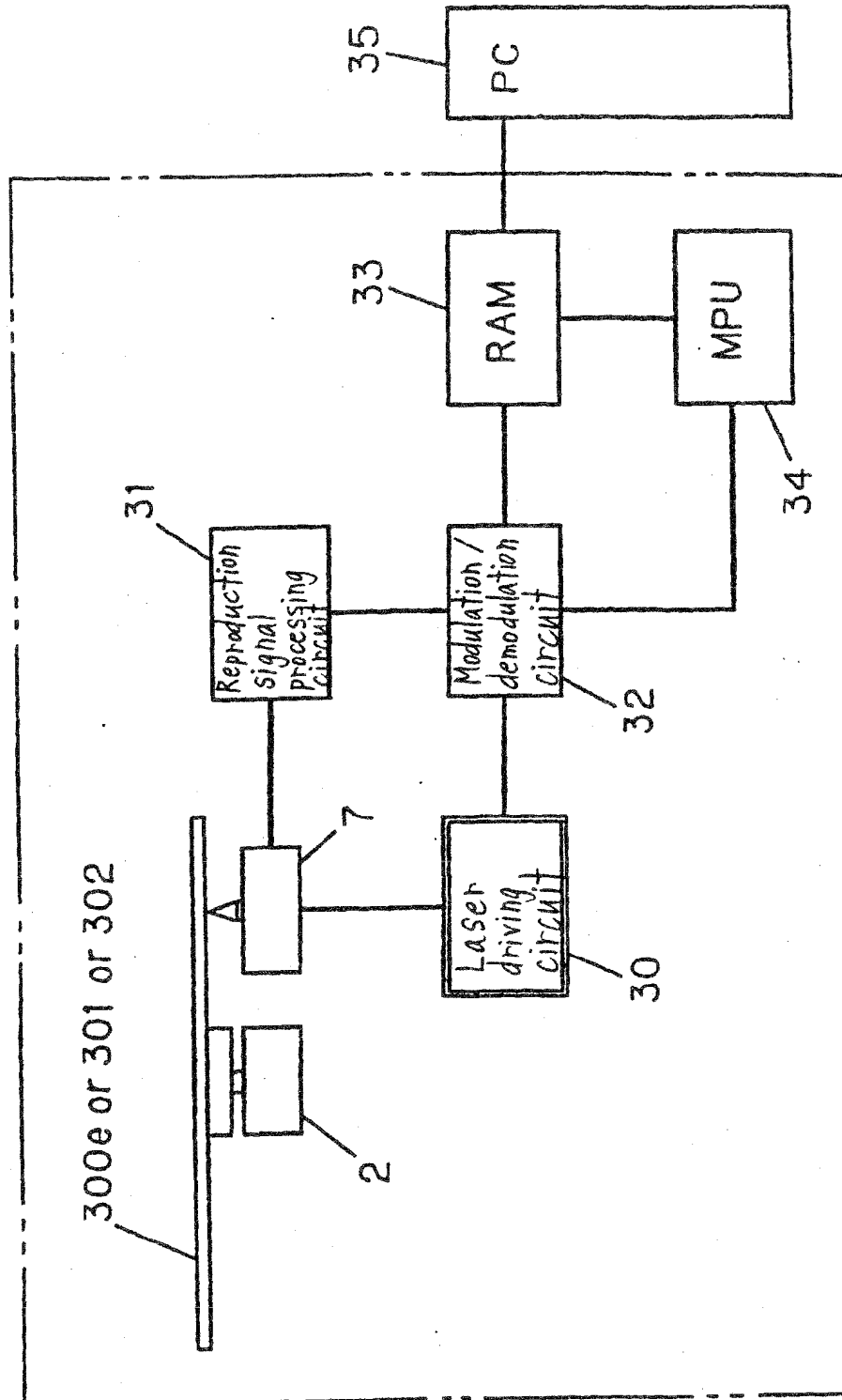
{ Fig. 9A }



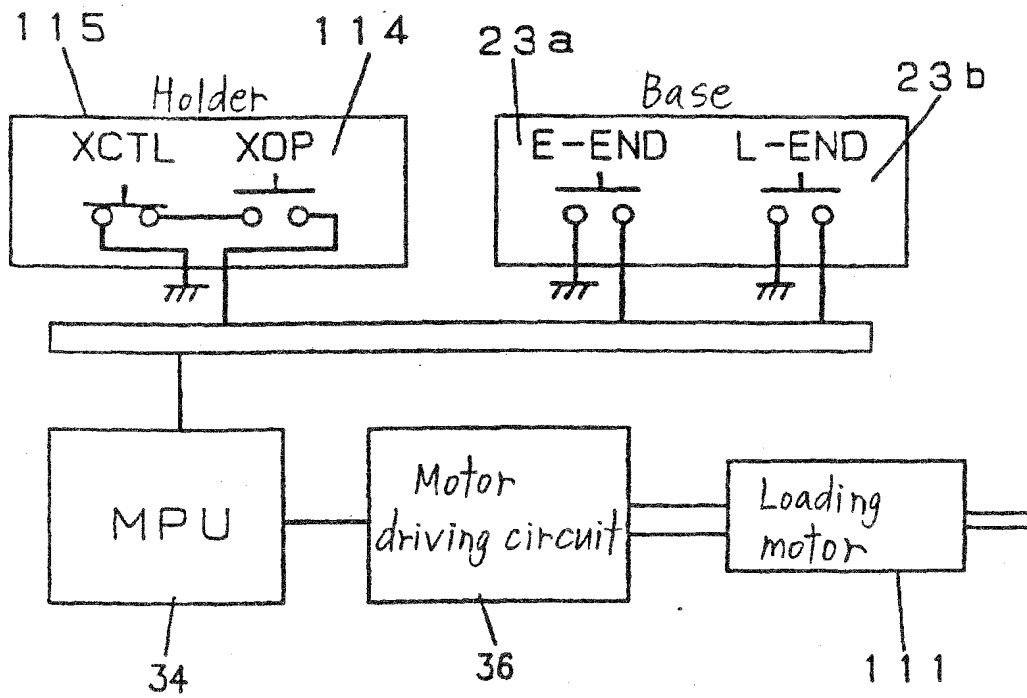
{ Fig. 9B }



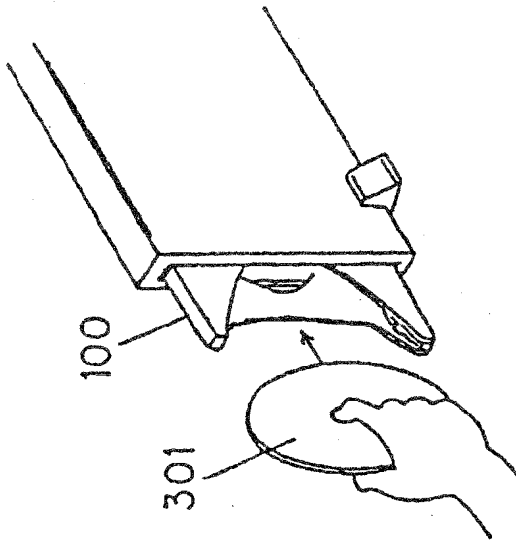
[Fig. 10]



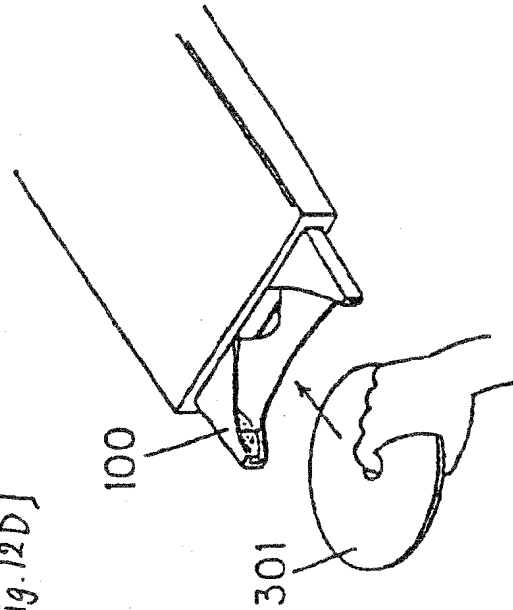
{ Fig. 11 }



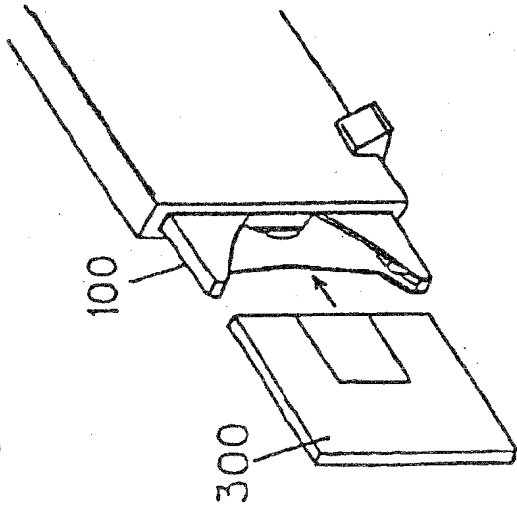
{ Fig. 12C }



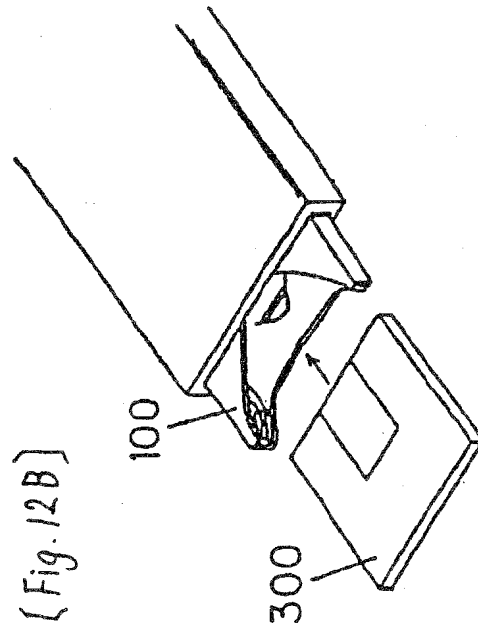
{ Fig. 12D }



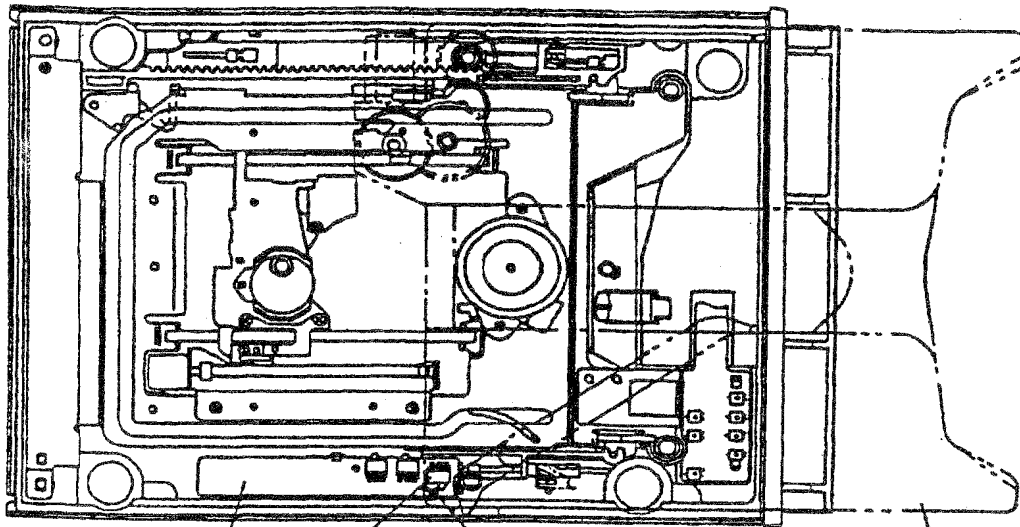
{ Fig. 12A }



{ Fig. 12B }



{Fig. 13A}



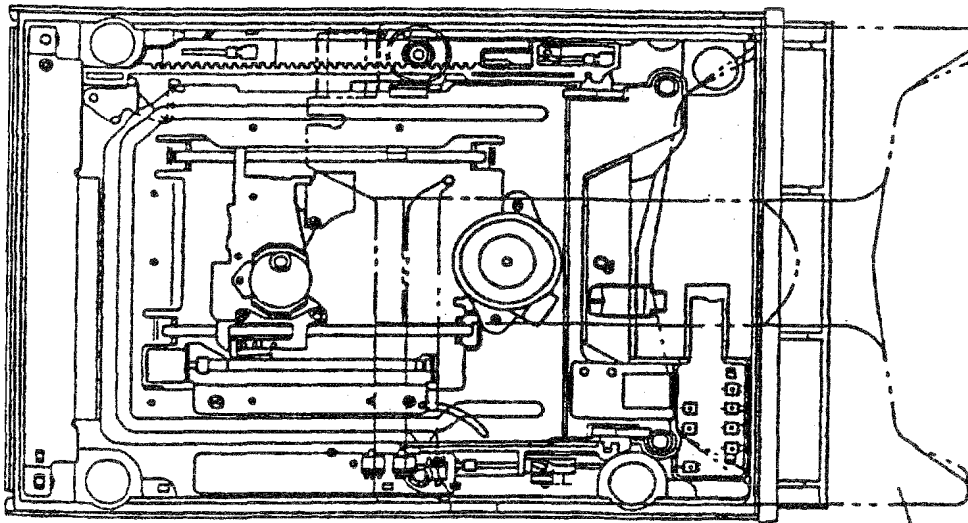
{Fig. 13B}

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23a

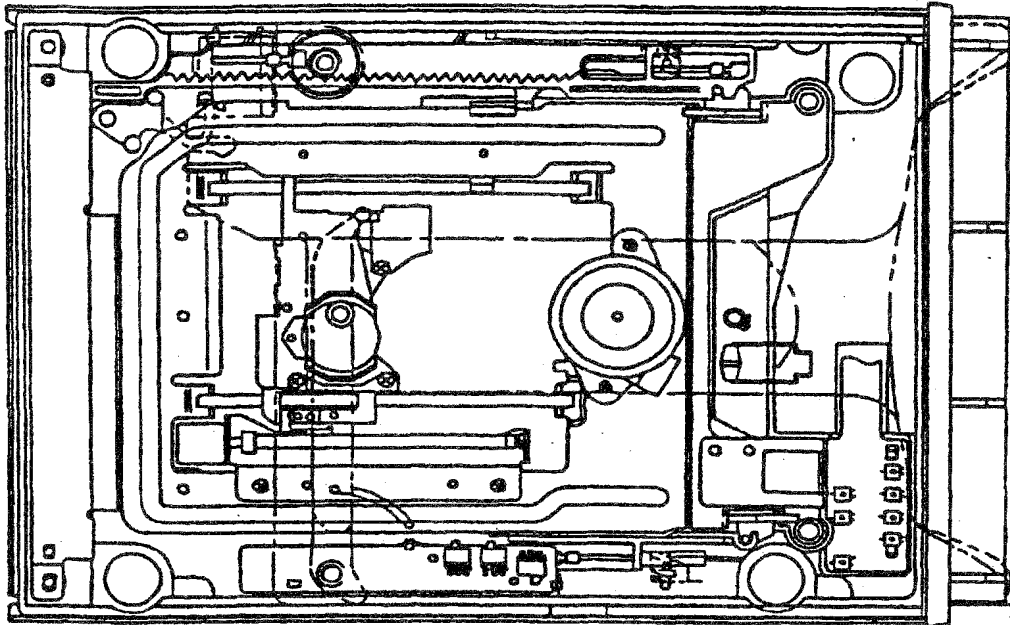
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100

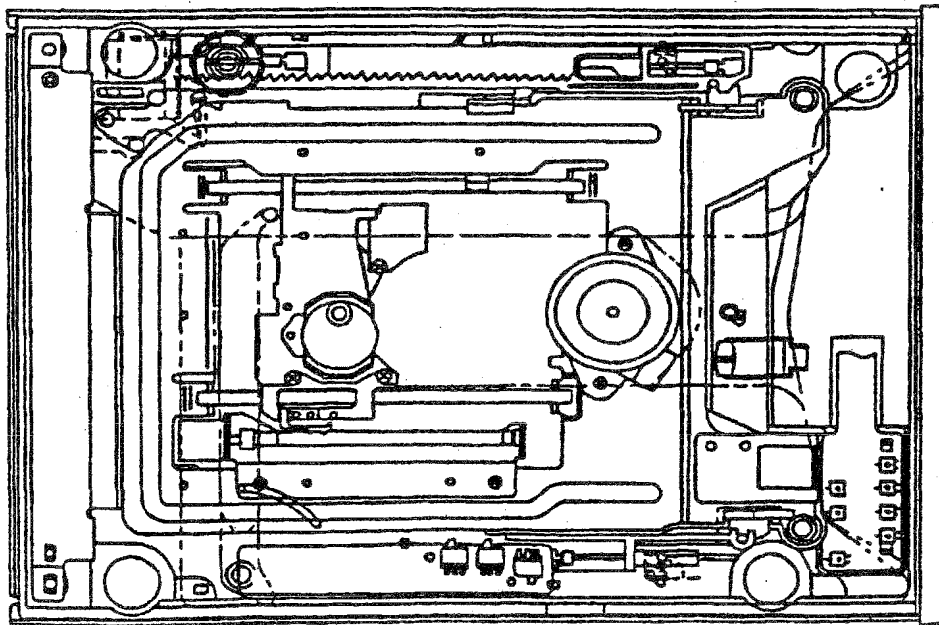


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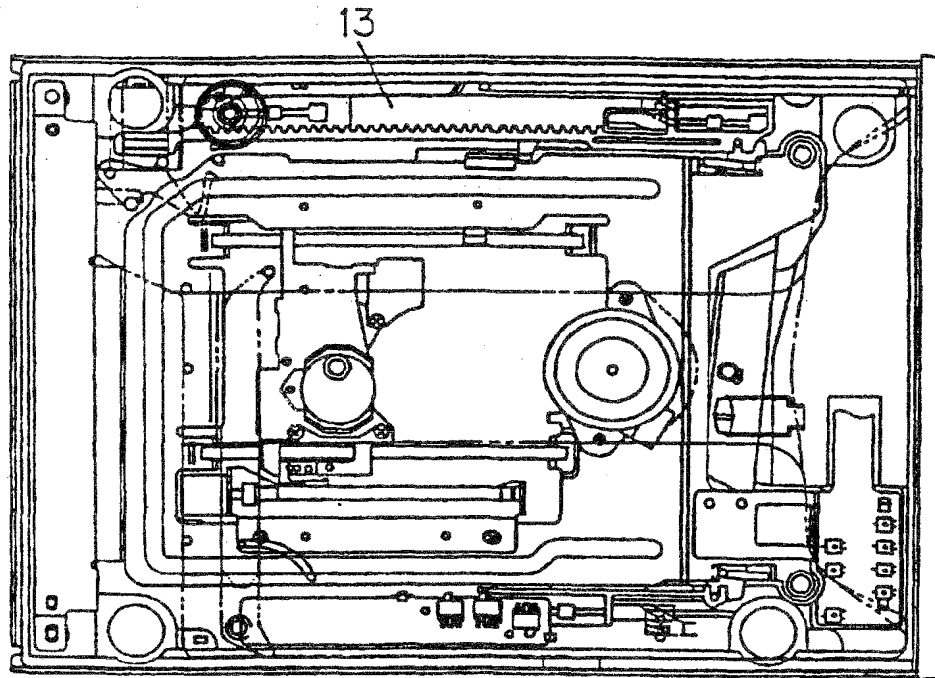
{ Fig. 14A }



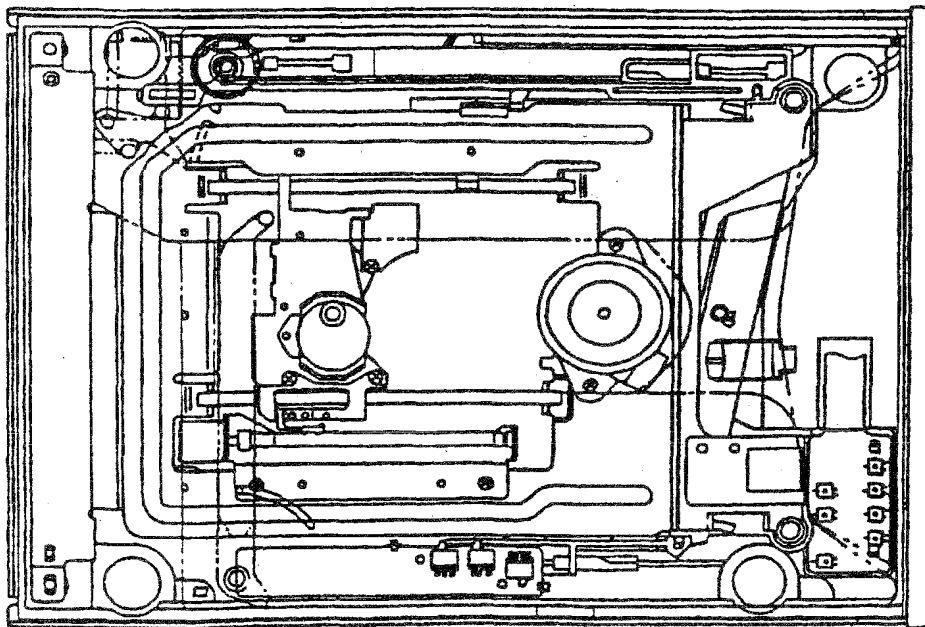
{ Fig. 14B }



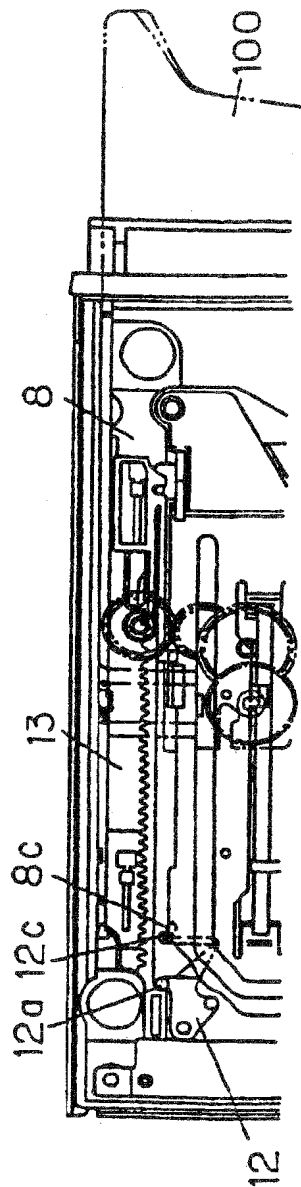
[Fig. 15A]



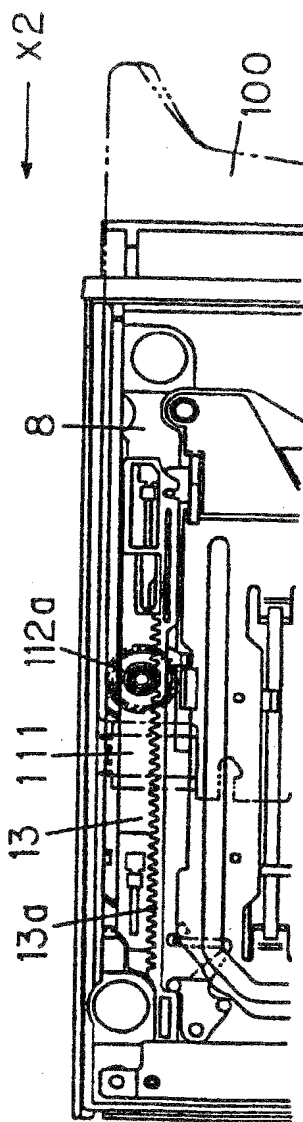
[Fig. 15B]



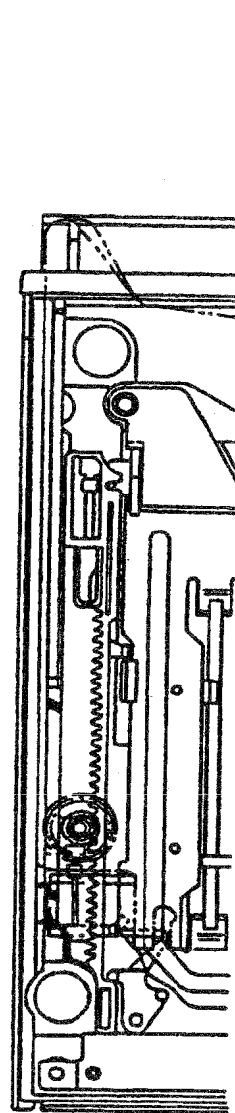
{ Fig. 16A }



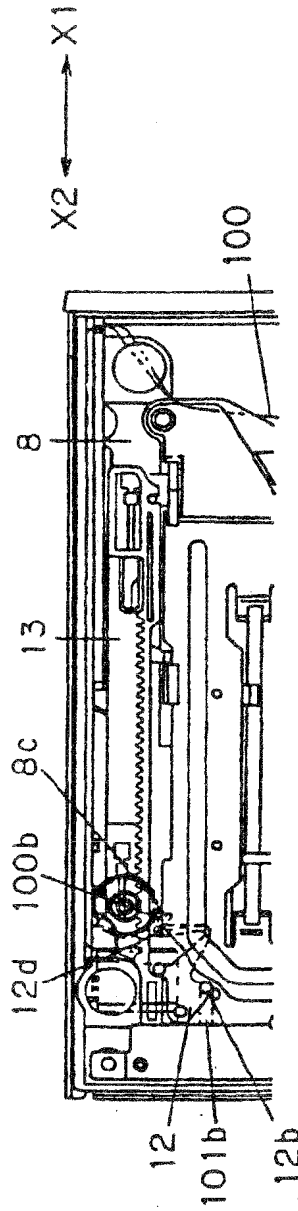
{ Fig. 16B }



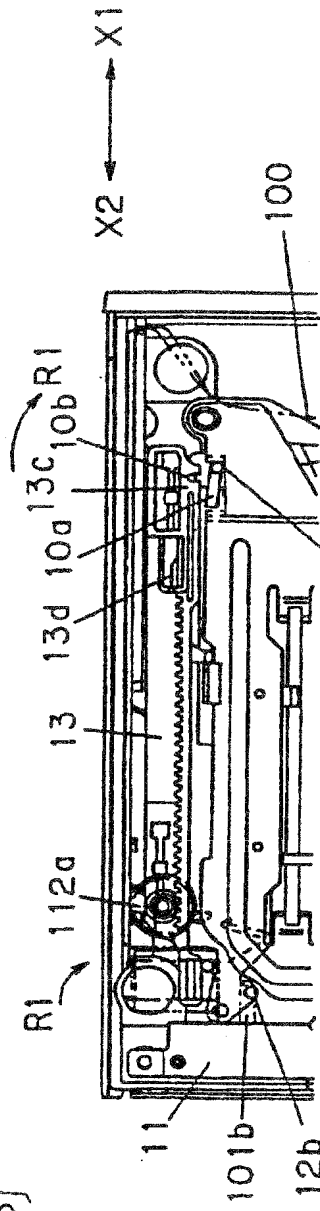
{ Fig. 16C }



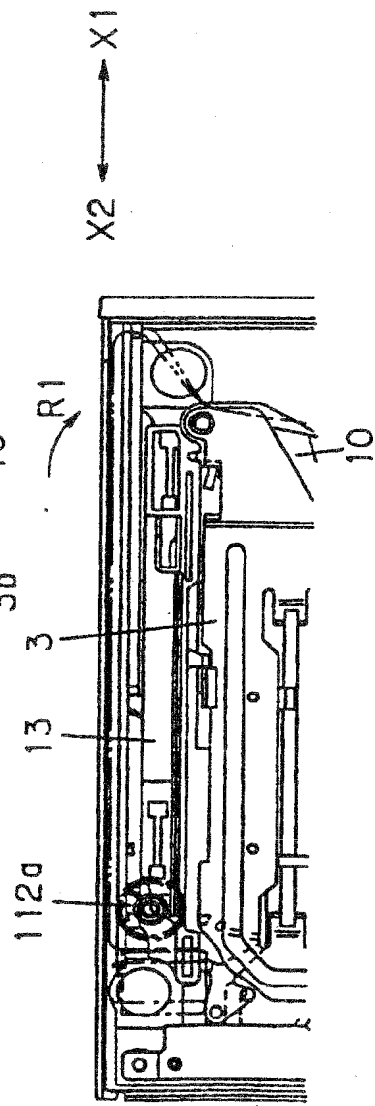
{ Fig. 17A }



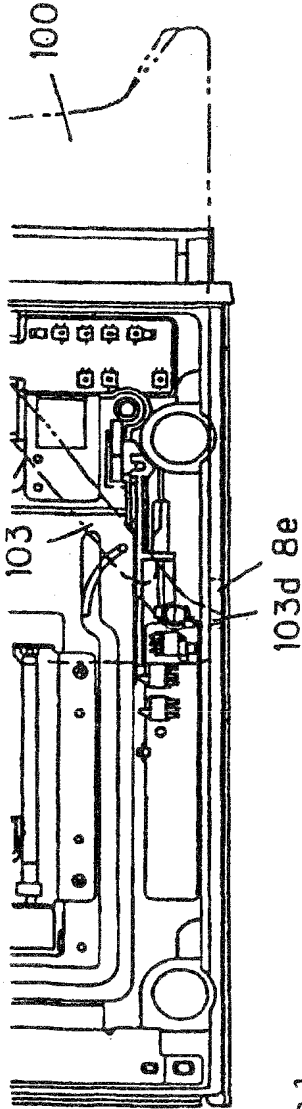
{ Fig. 17B }



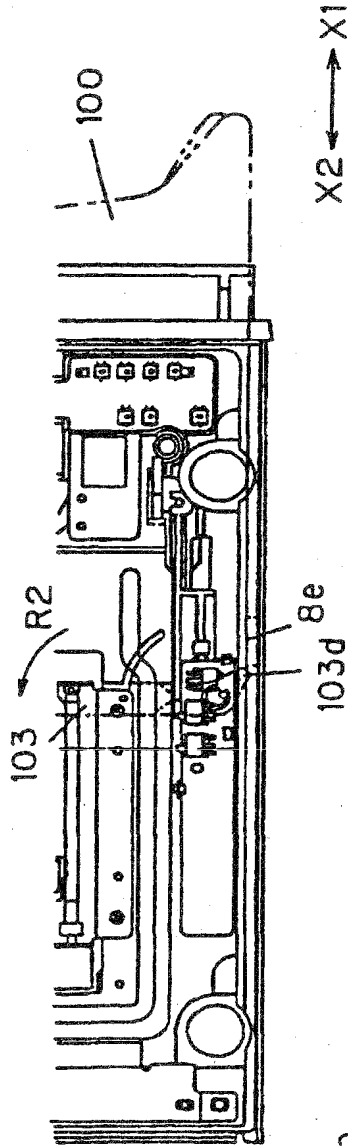
{ Fig. 17C }



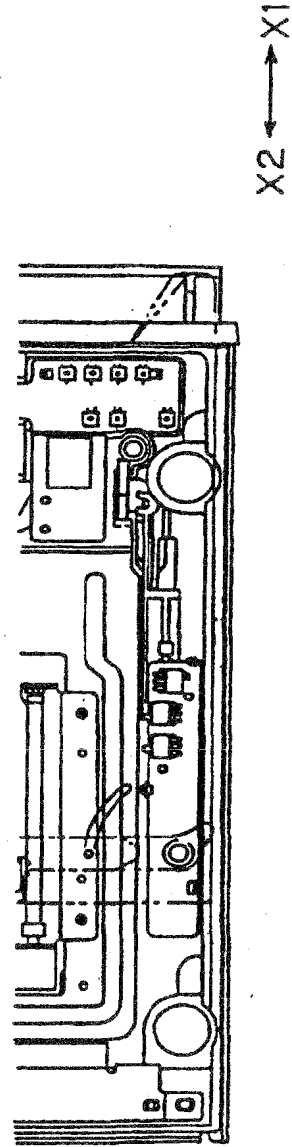
[Fig. 18A]



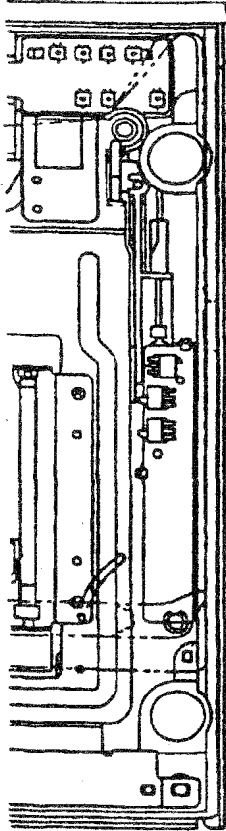
[Fig. 18B]



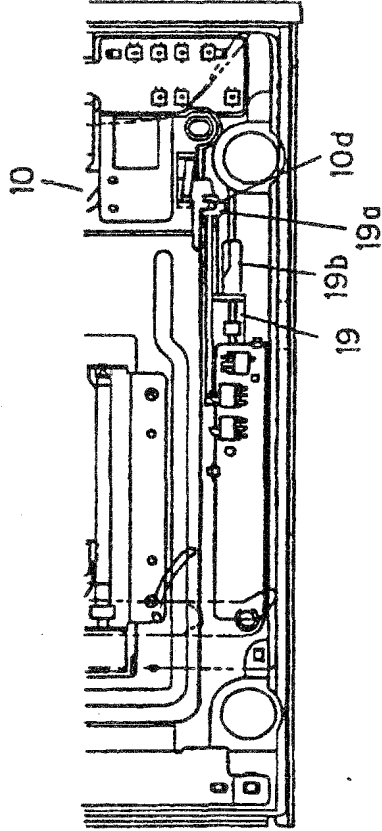
[Fig. 18C]



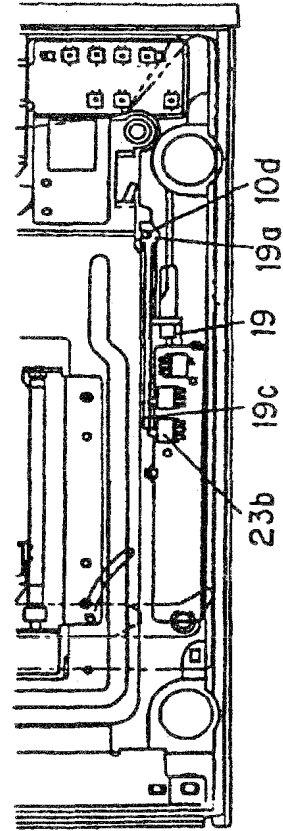
[Fig. 19A]

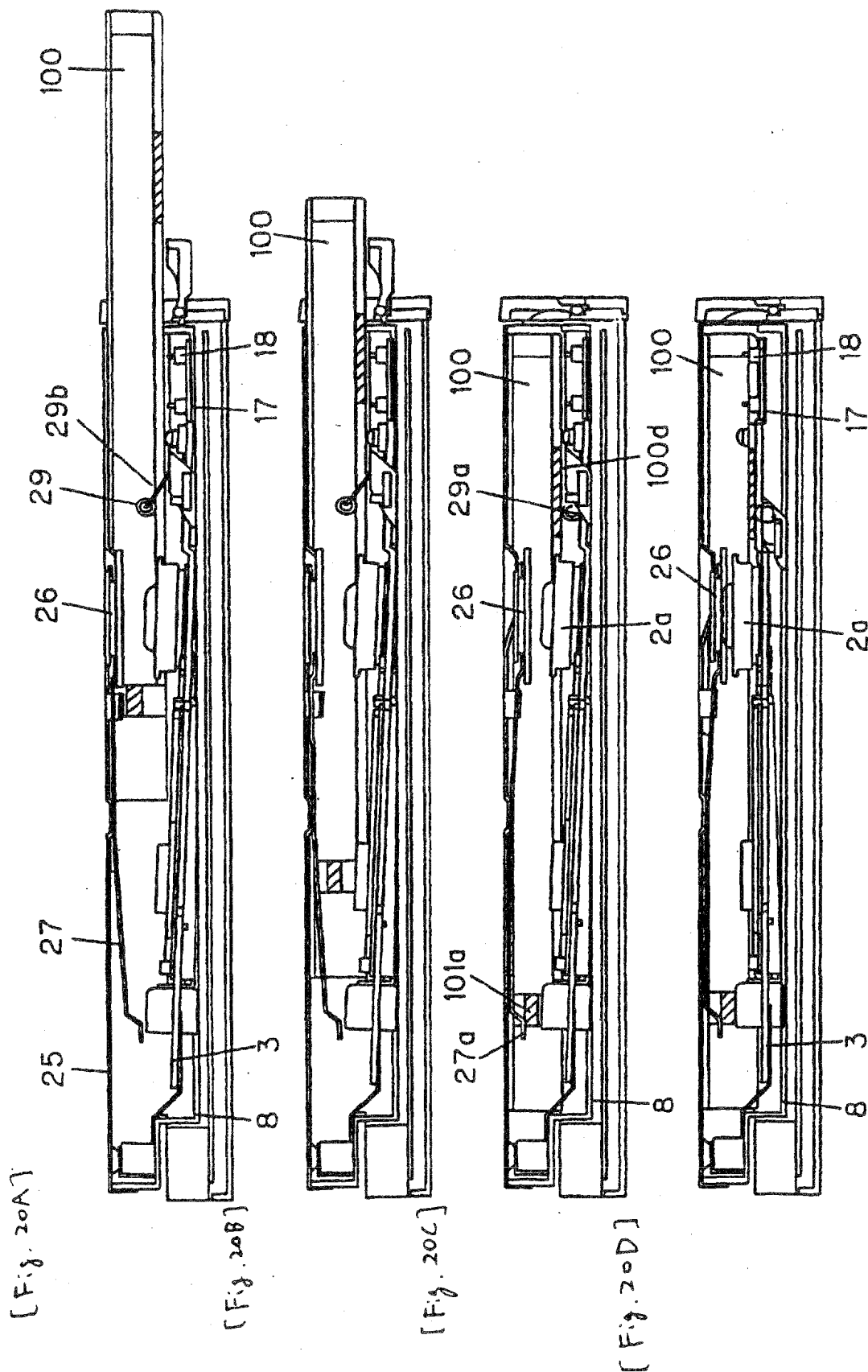


[Fig. 19B]

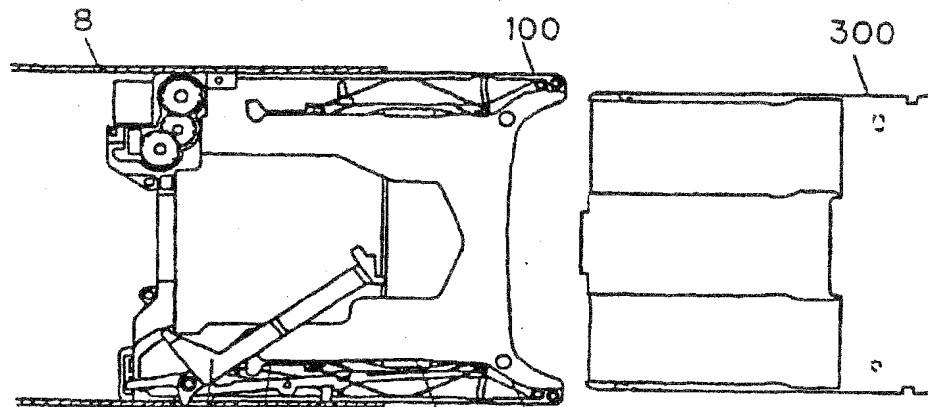


[Fig. 19C]

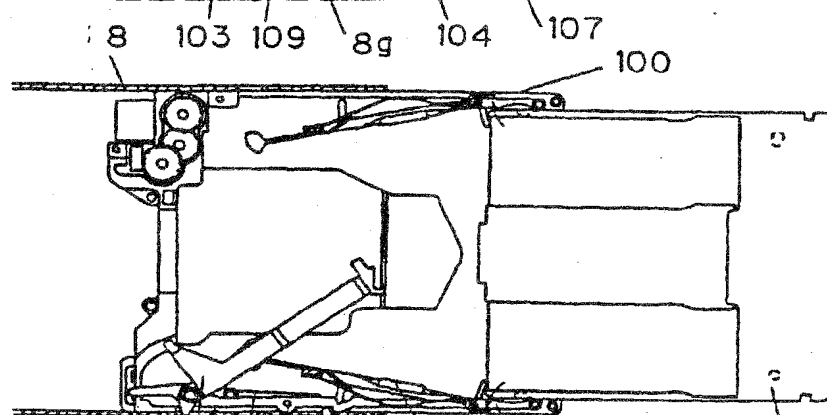




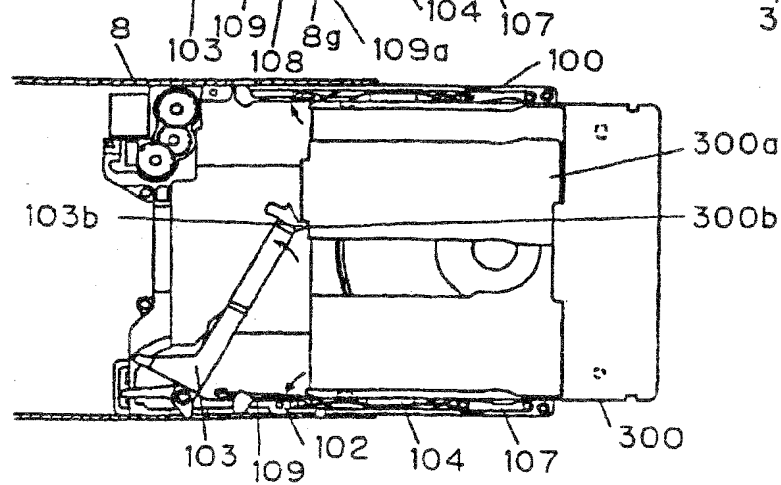
[Fig. 21A]



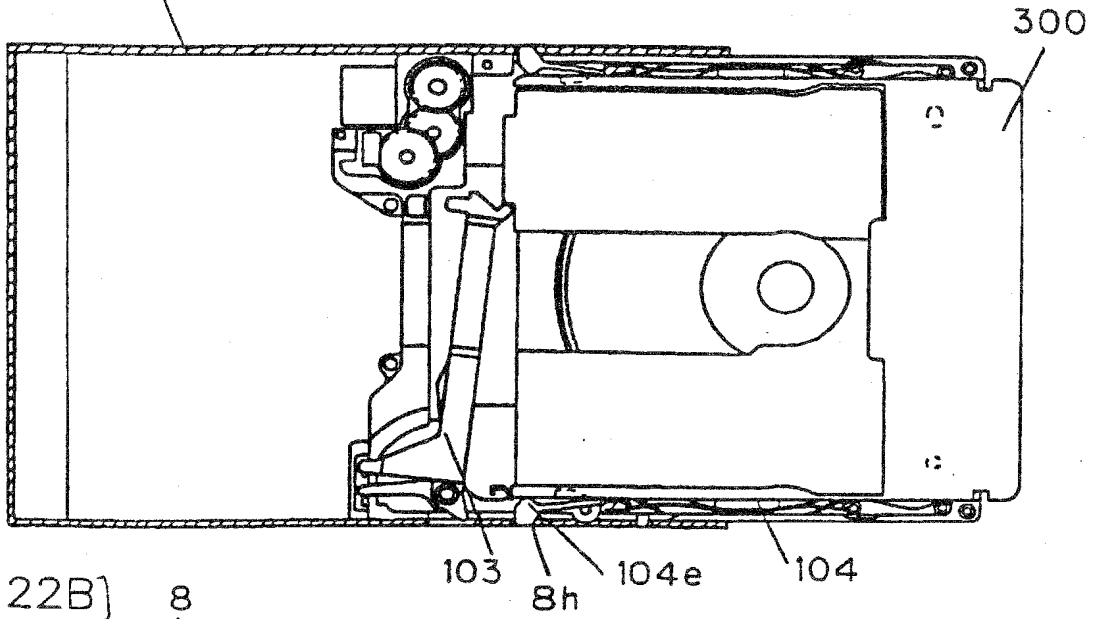
[Fig. 21B]



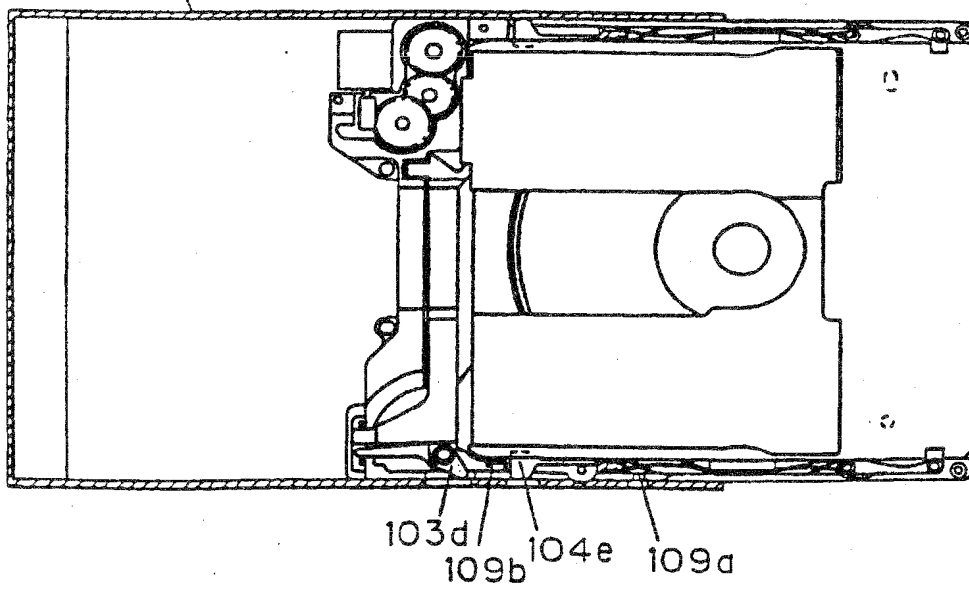
[Fig. 21C]

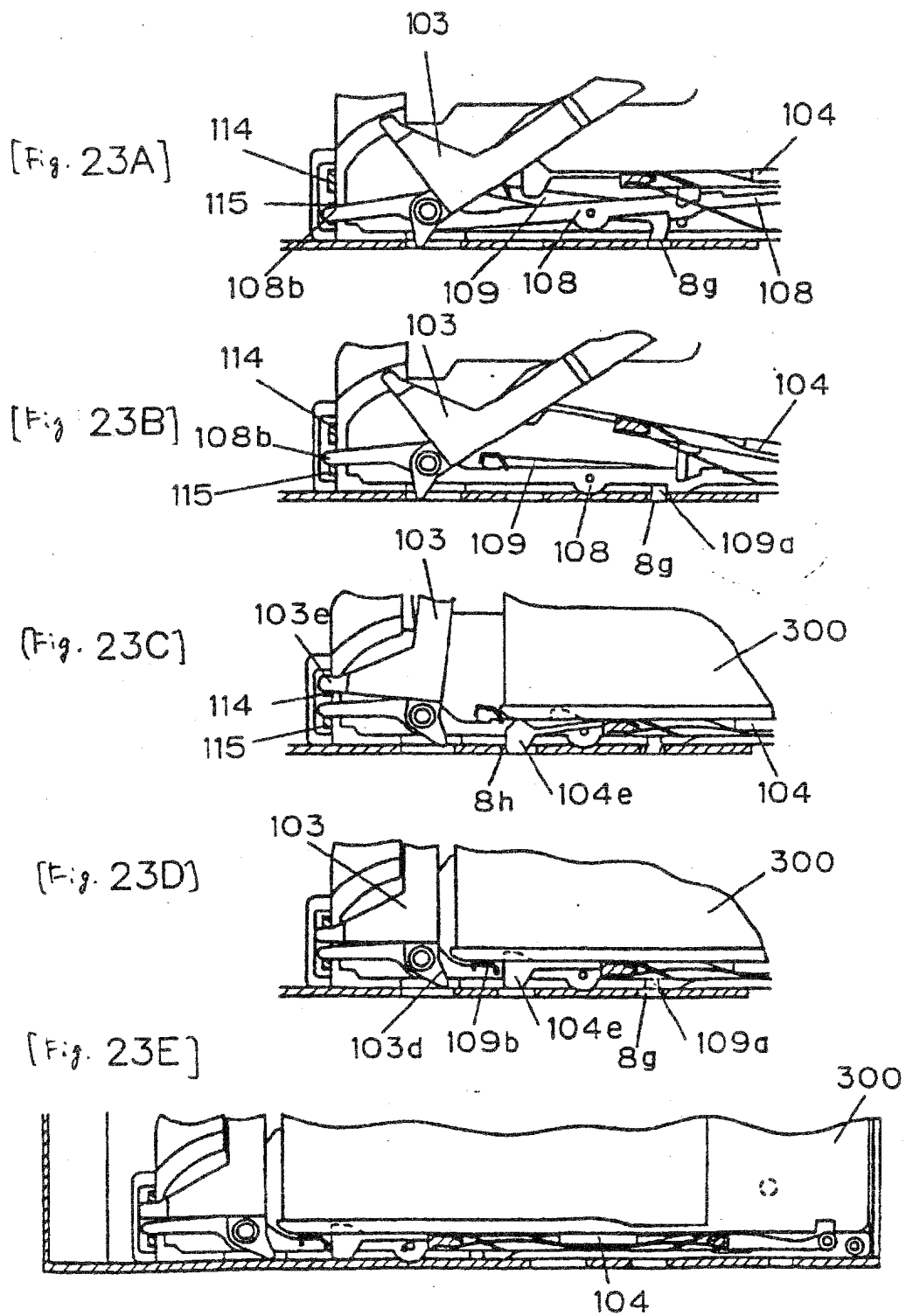


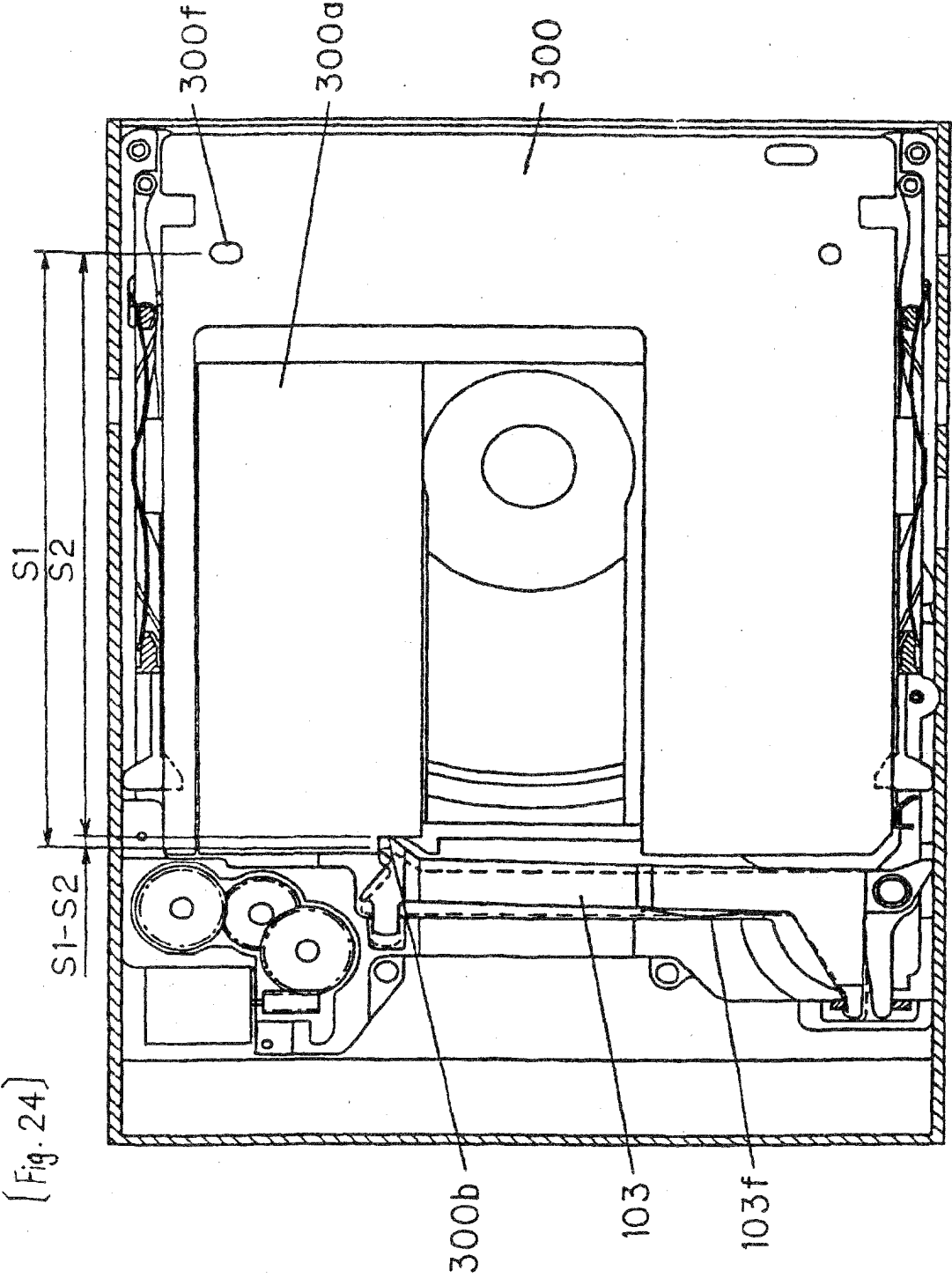
[Fig. 22A] 8

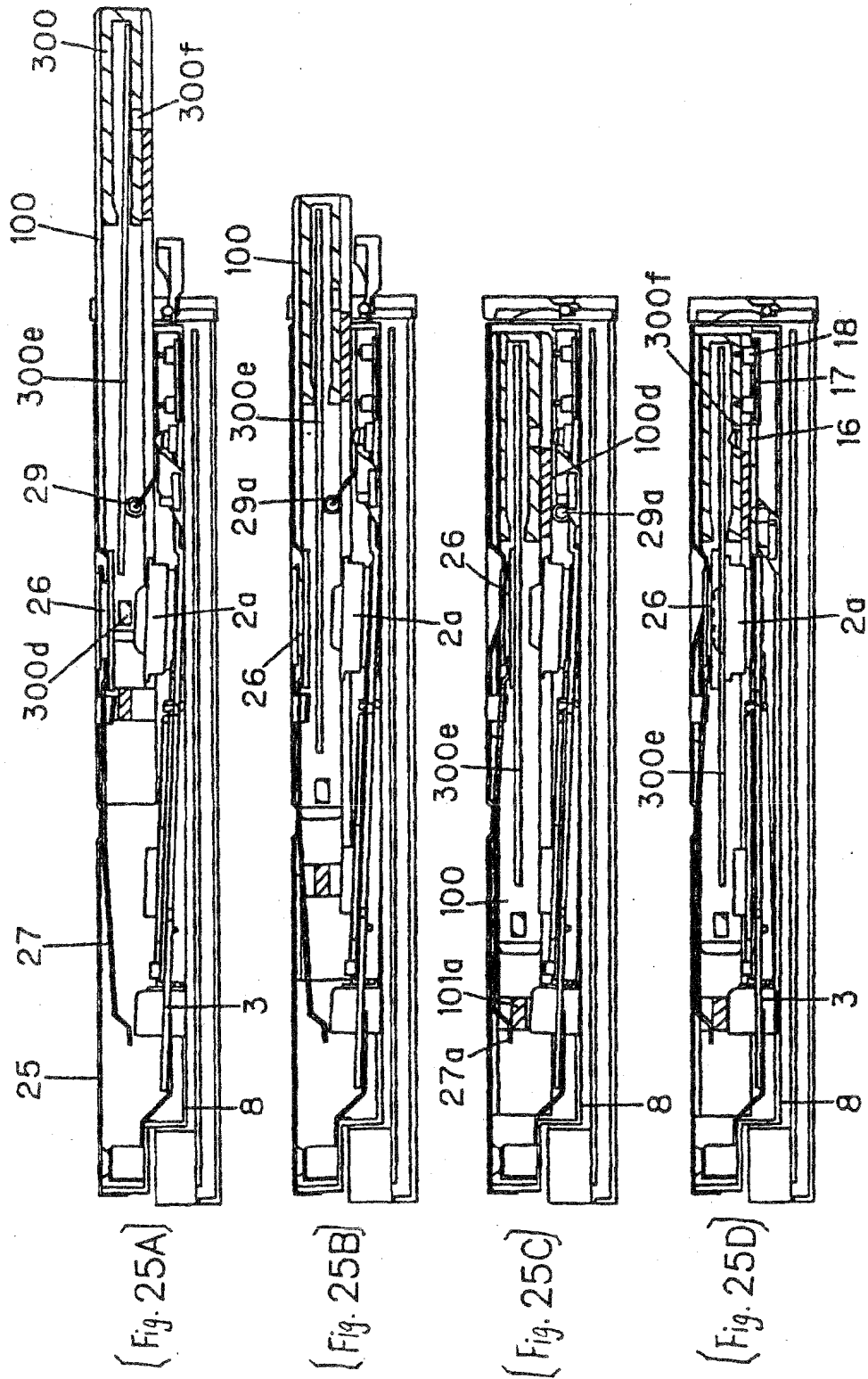


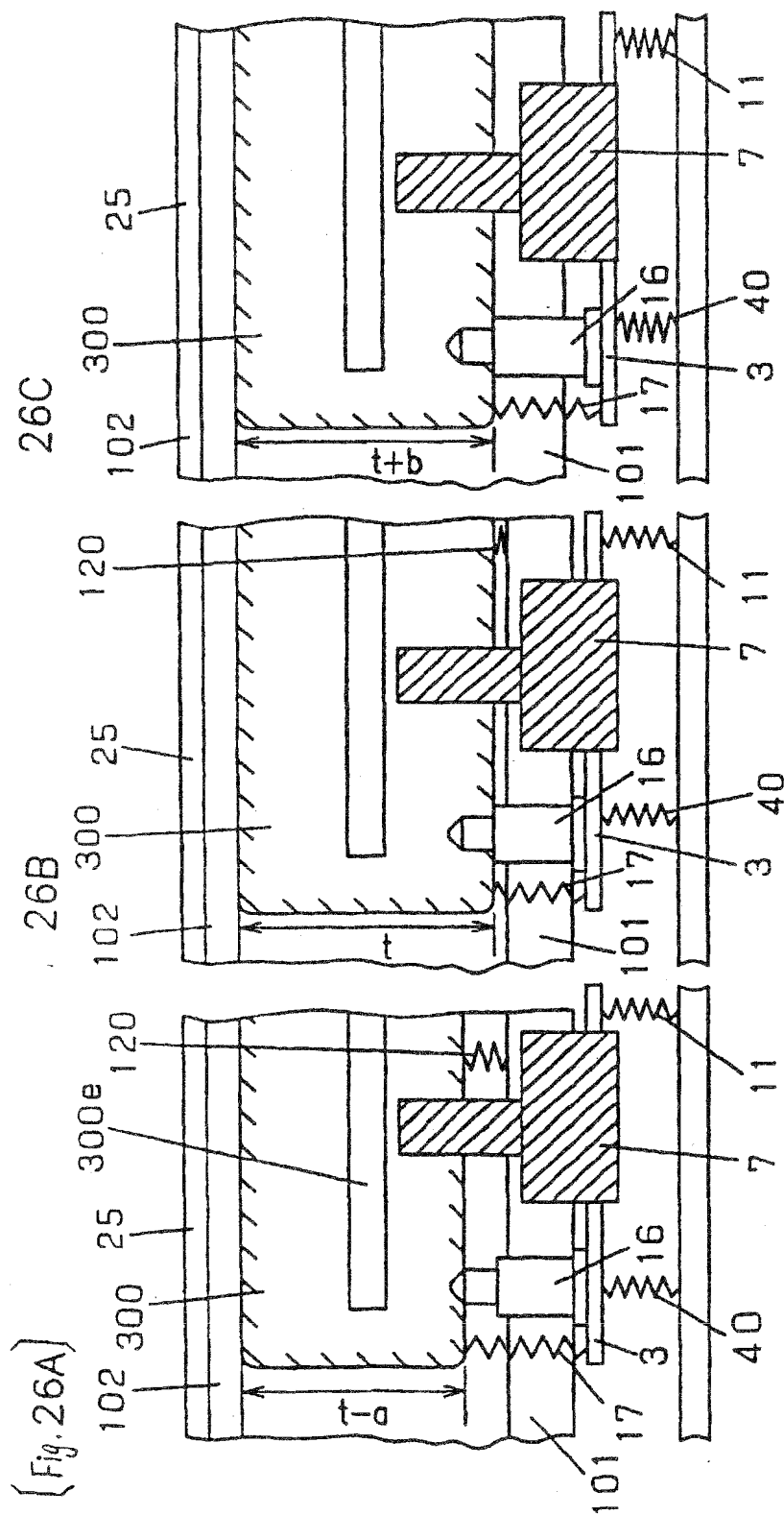
[Fig. 22B] 8

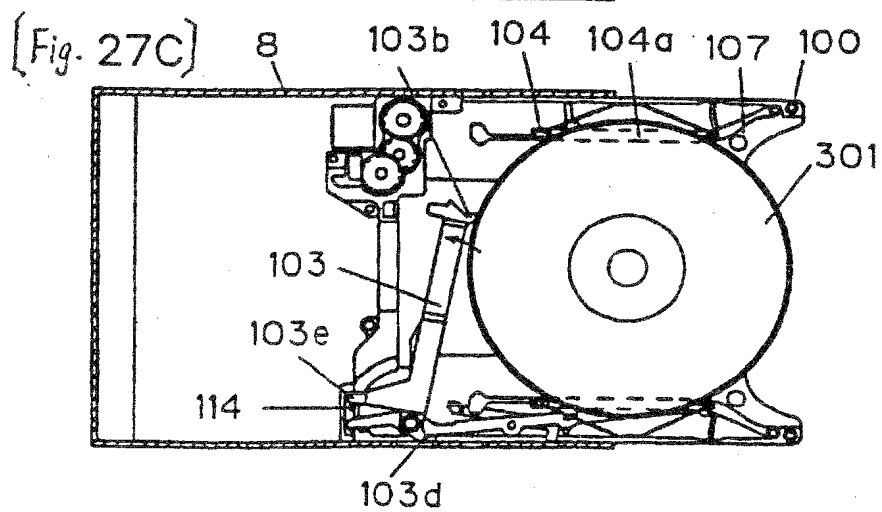
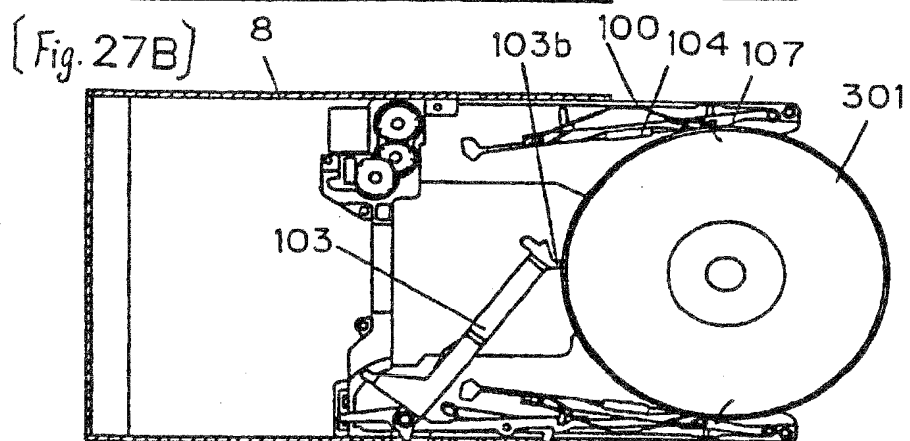
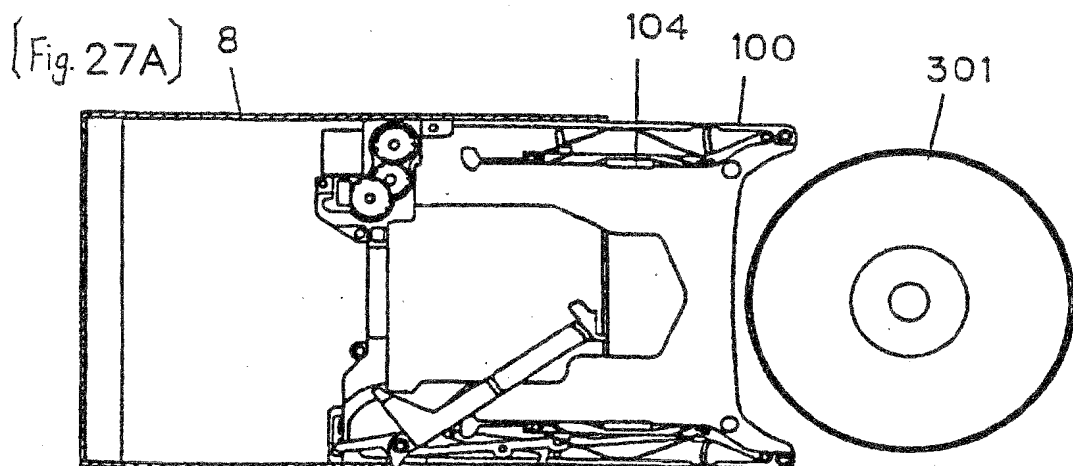




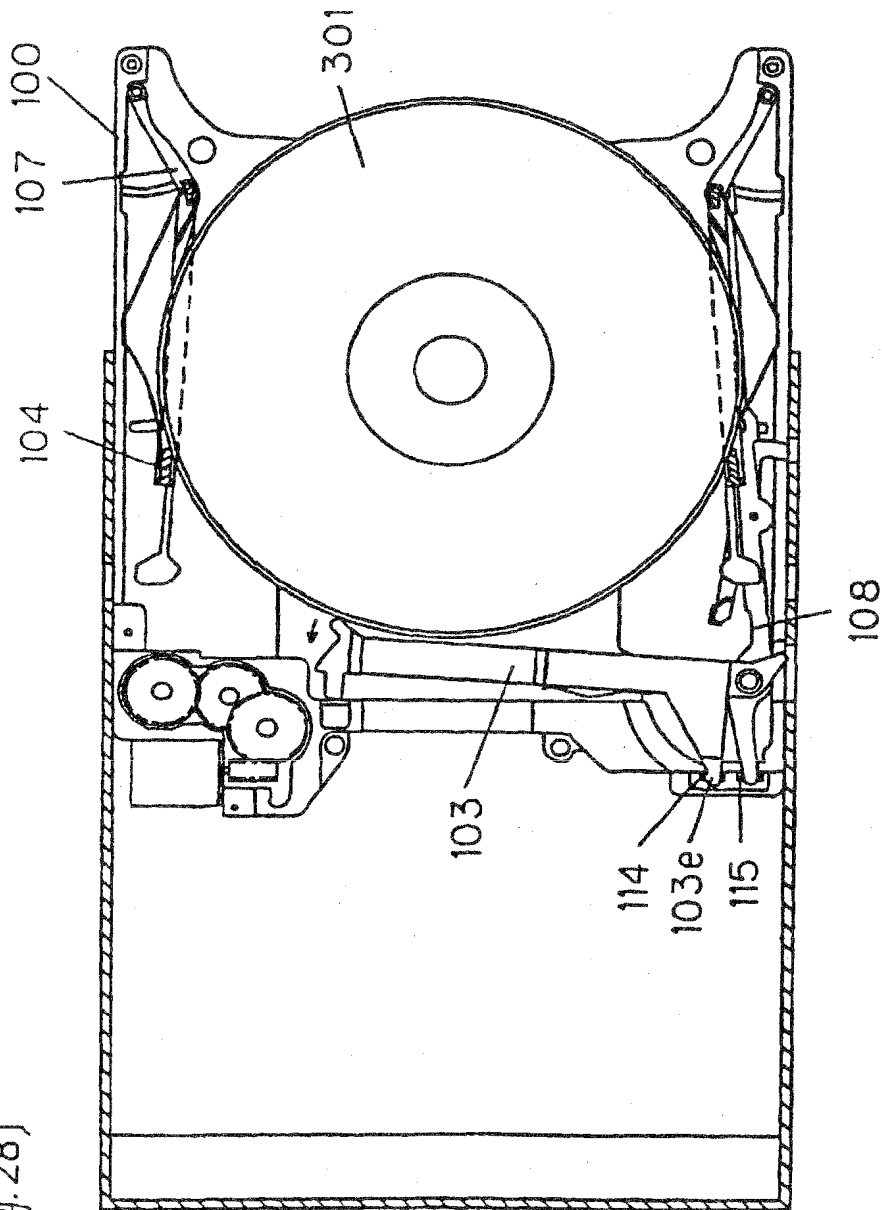


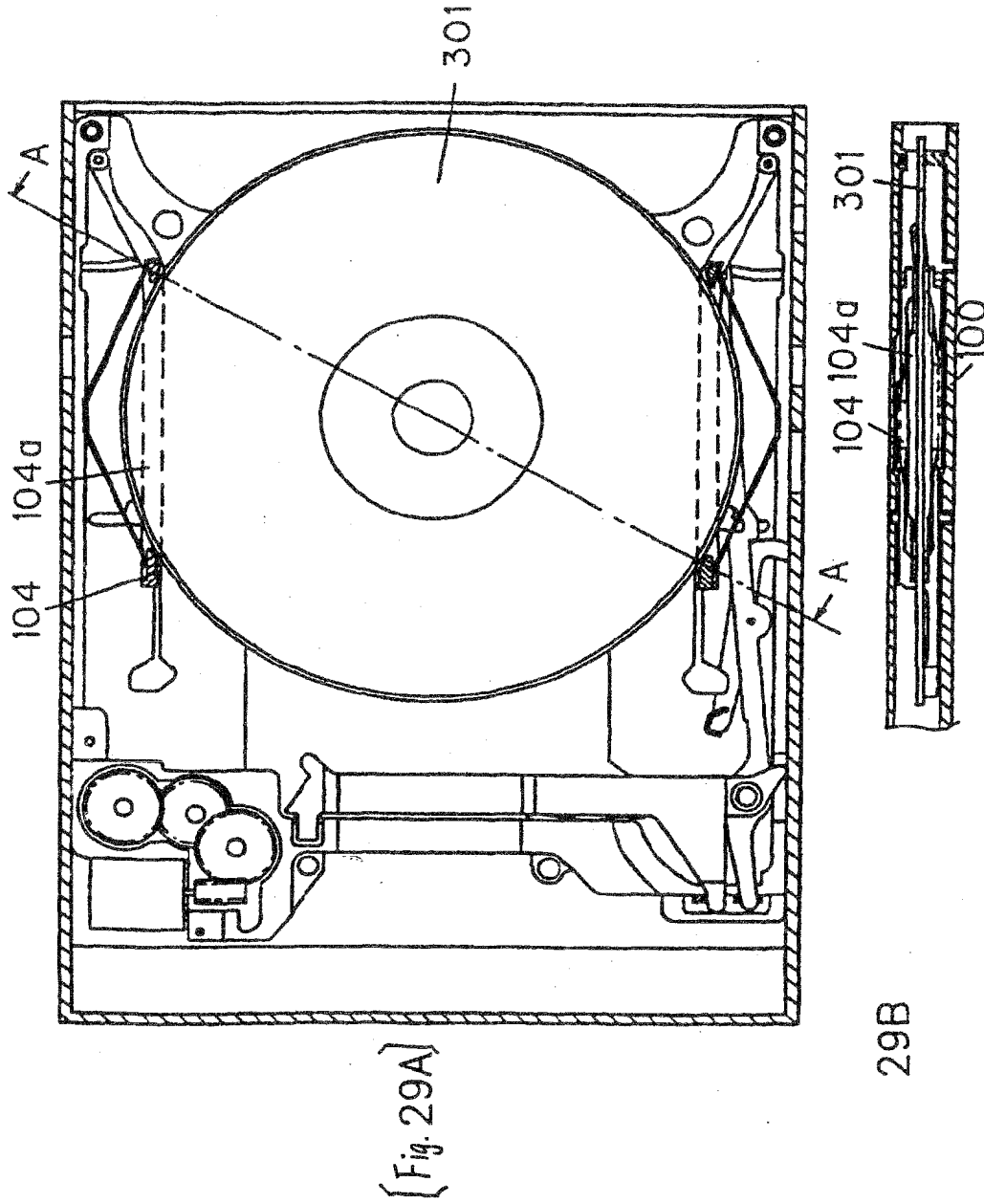


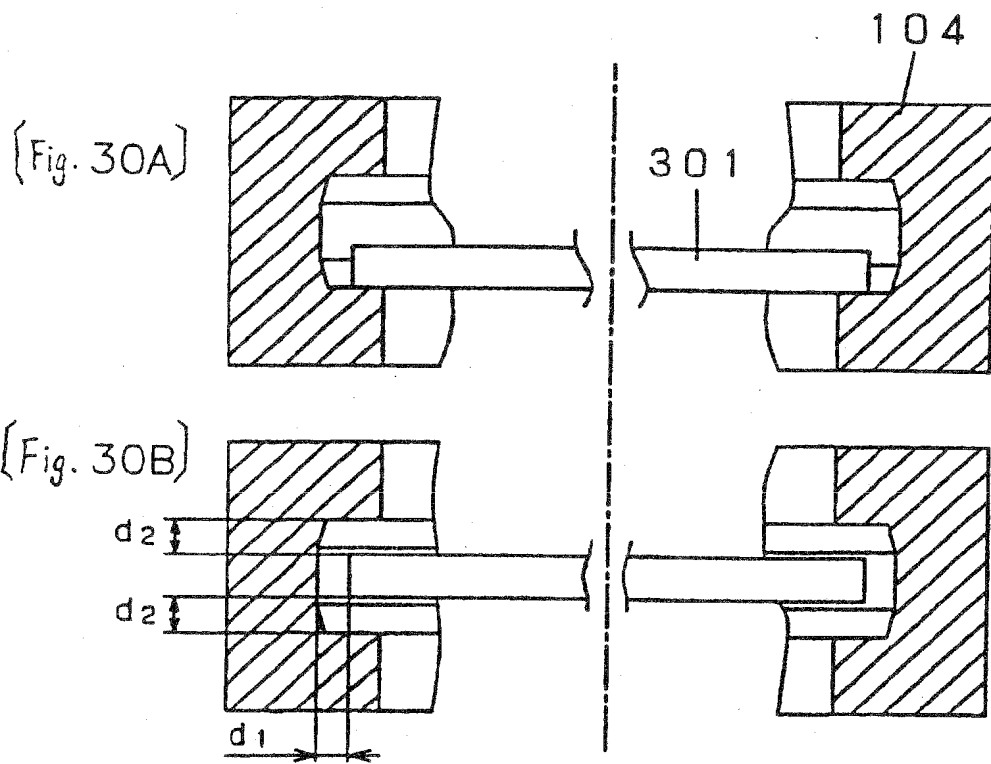


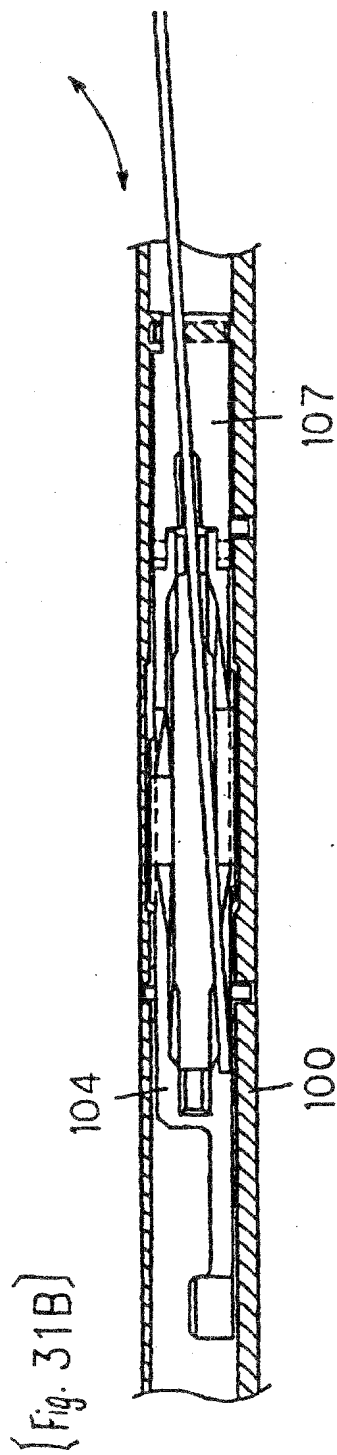
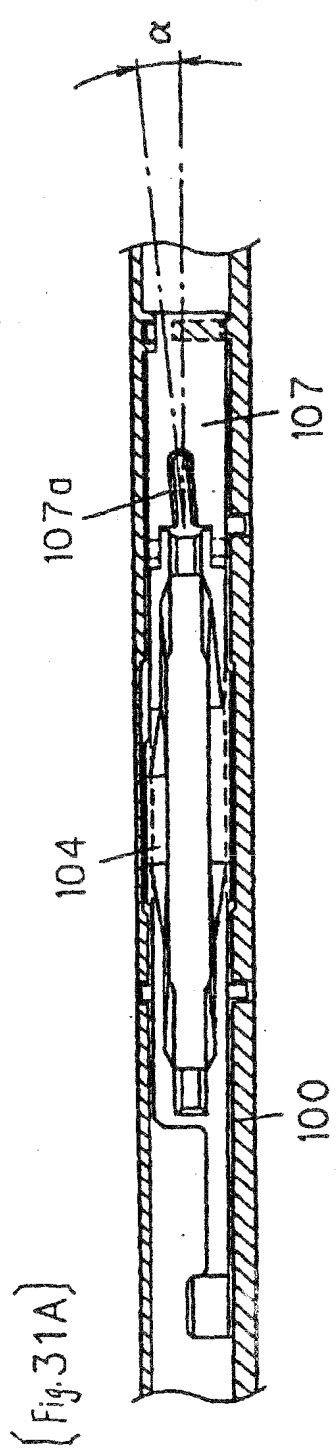


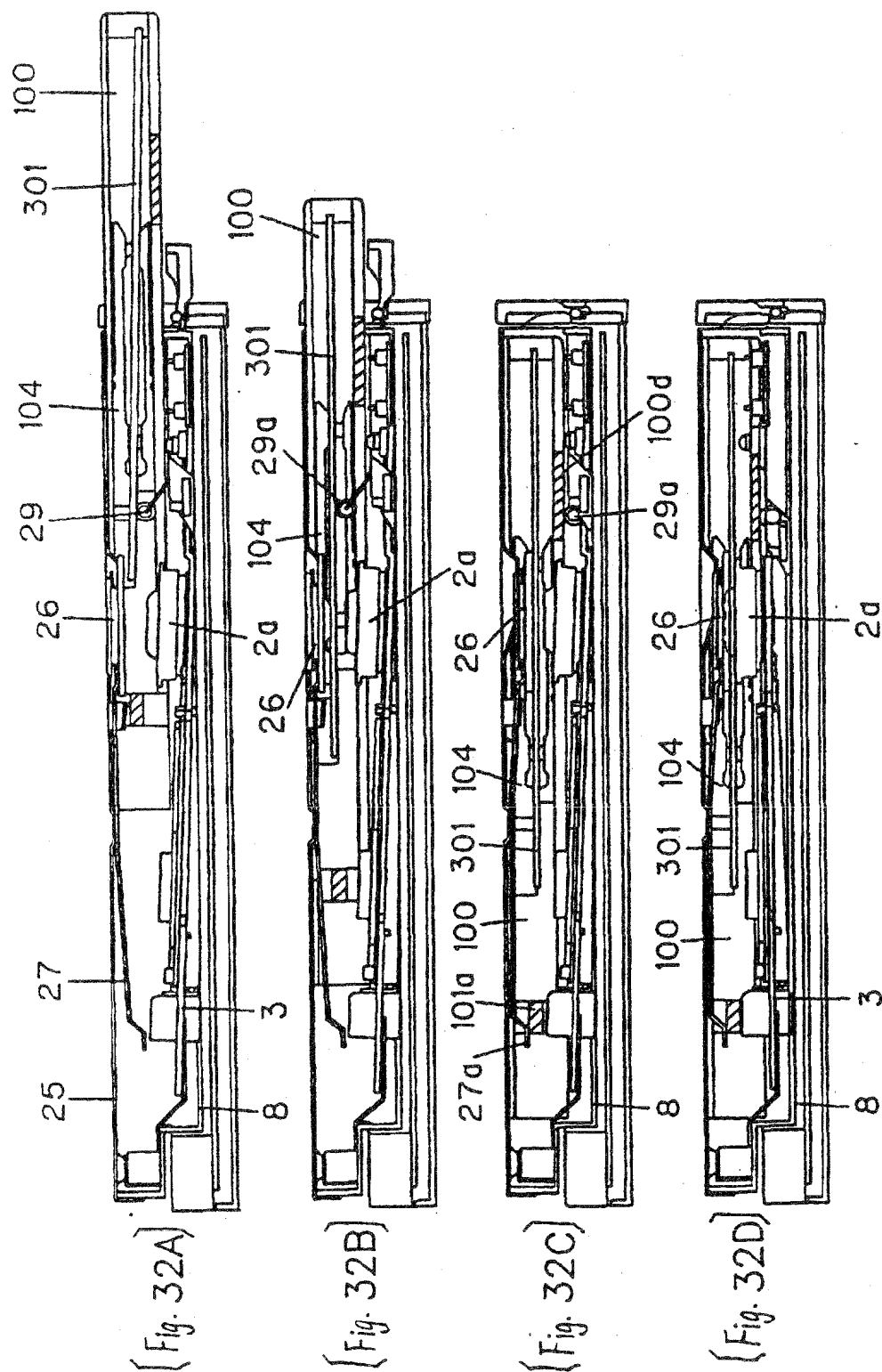
{ Fig. 28 }



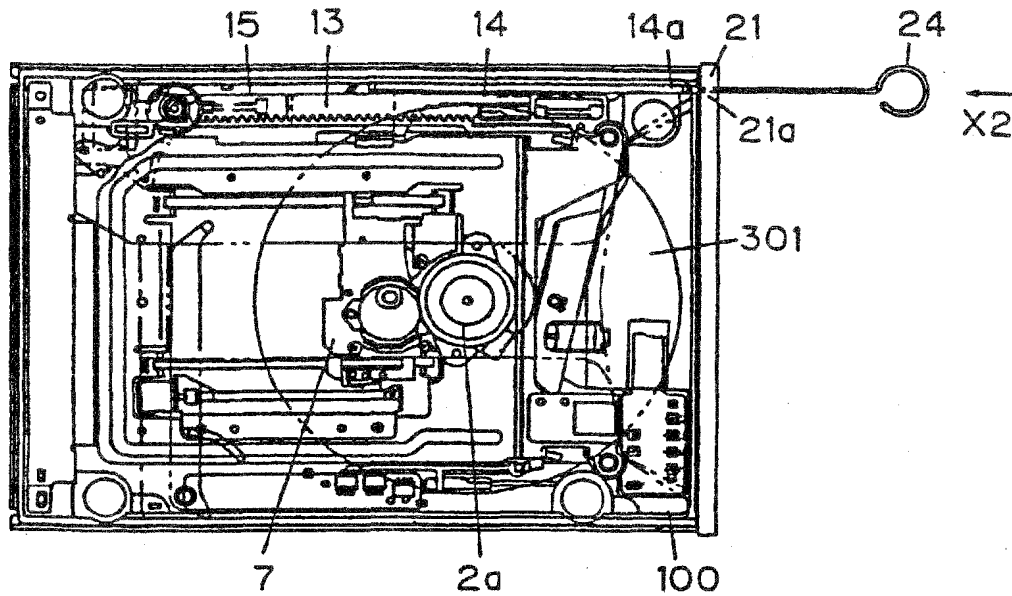




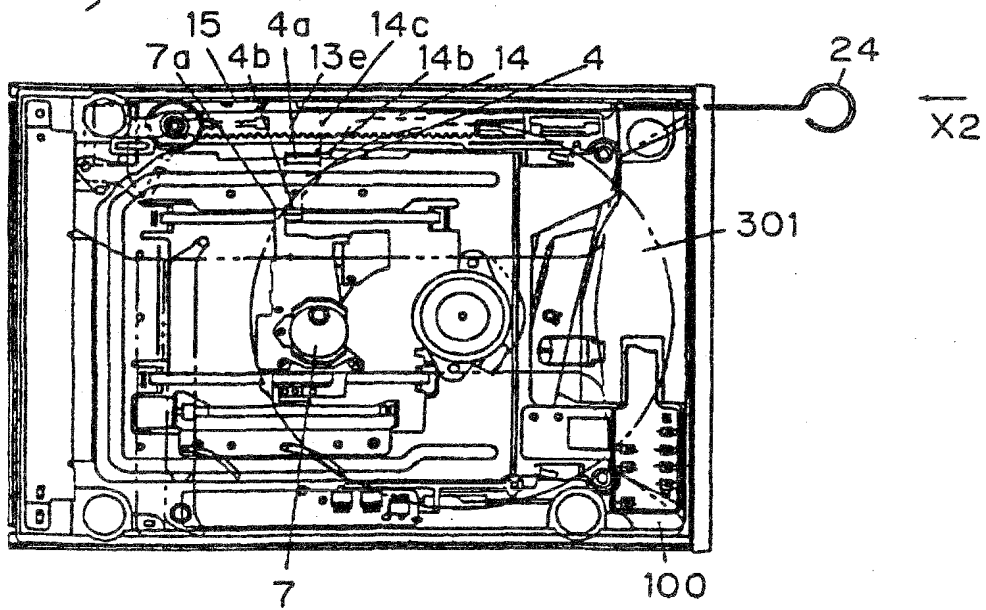




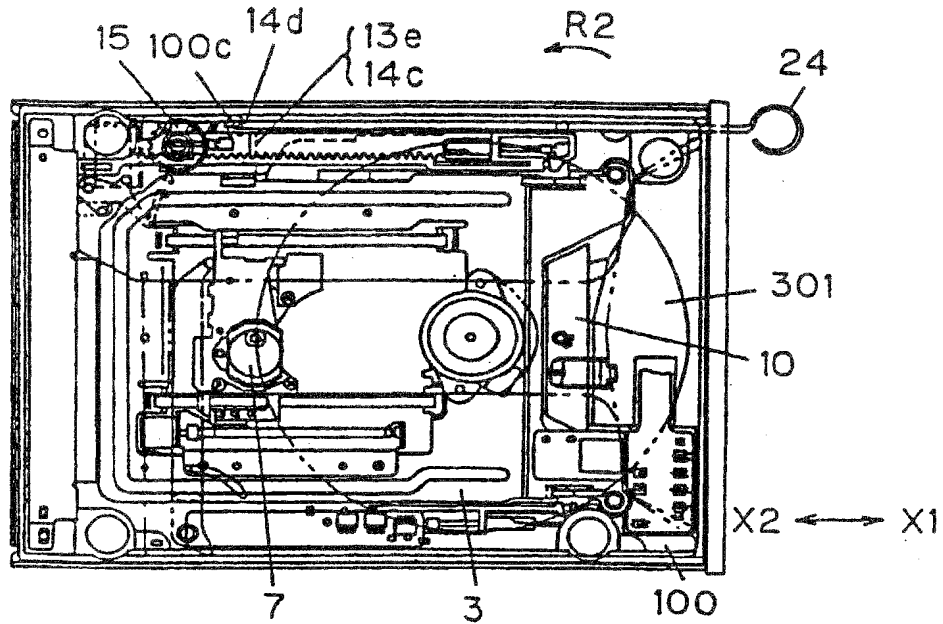
[Fig. 33A]



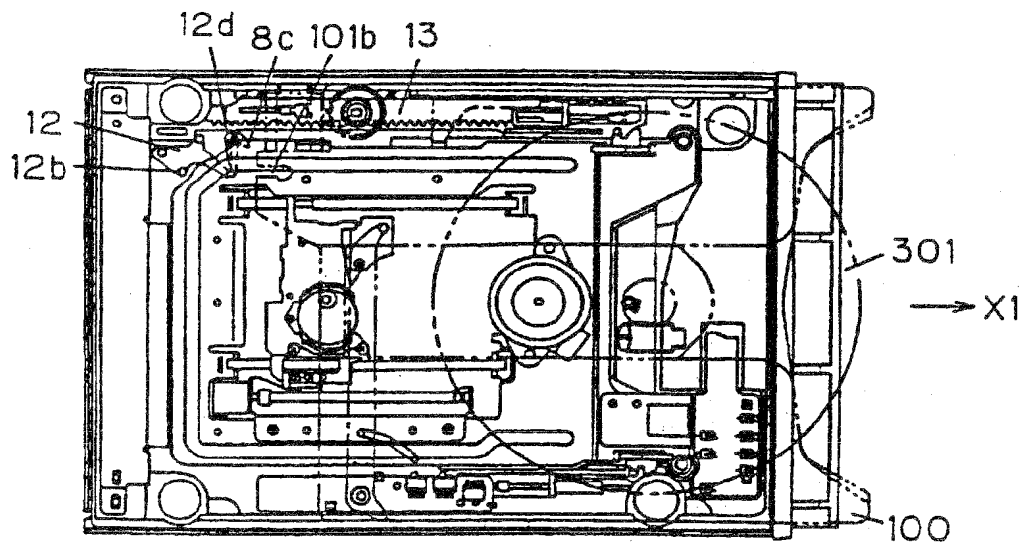
[Fig. 33B]

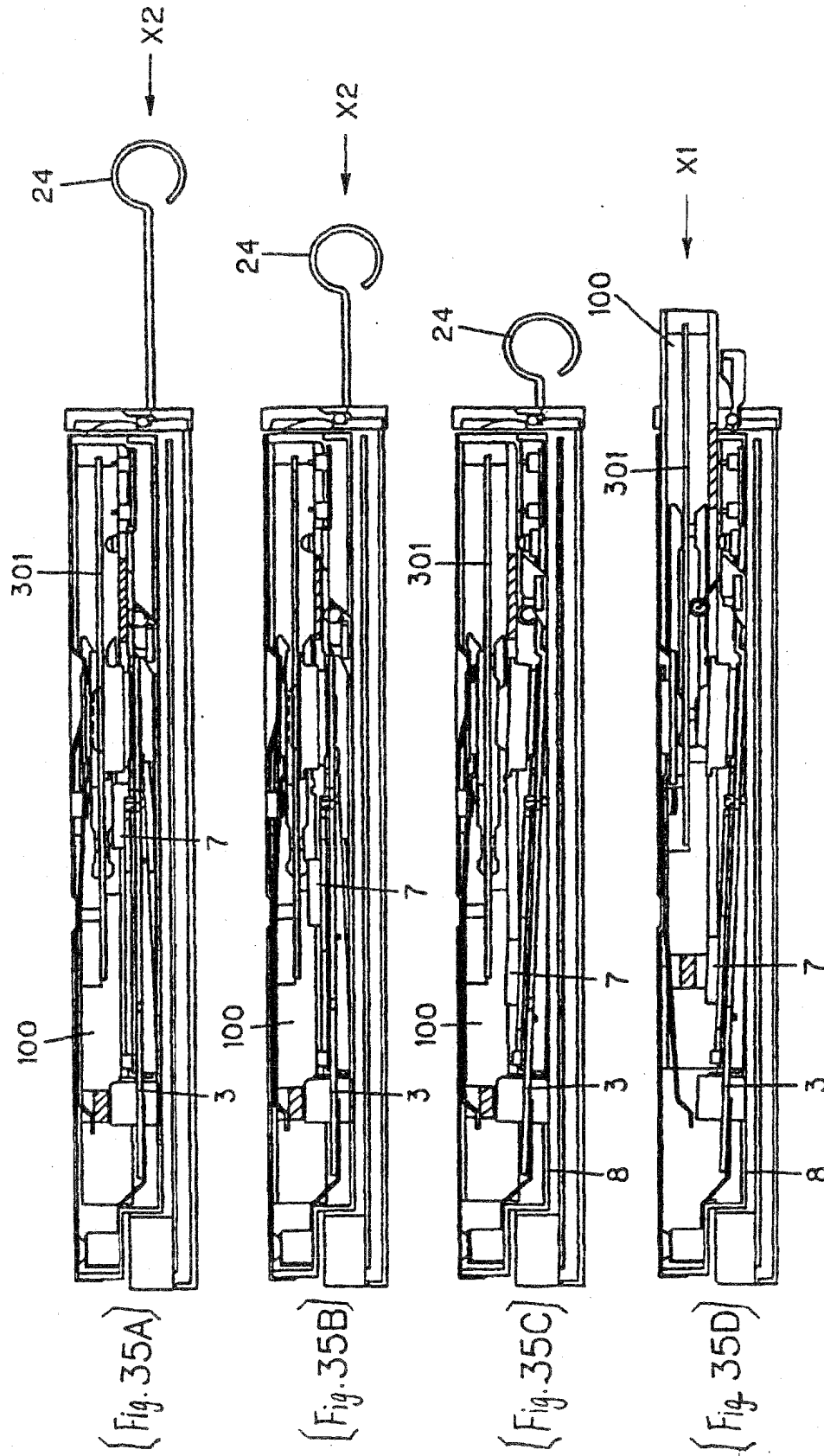


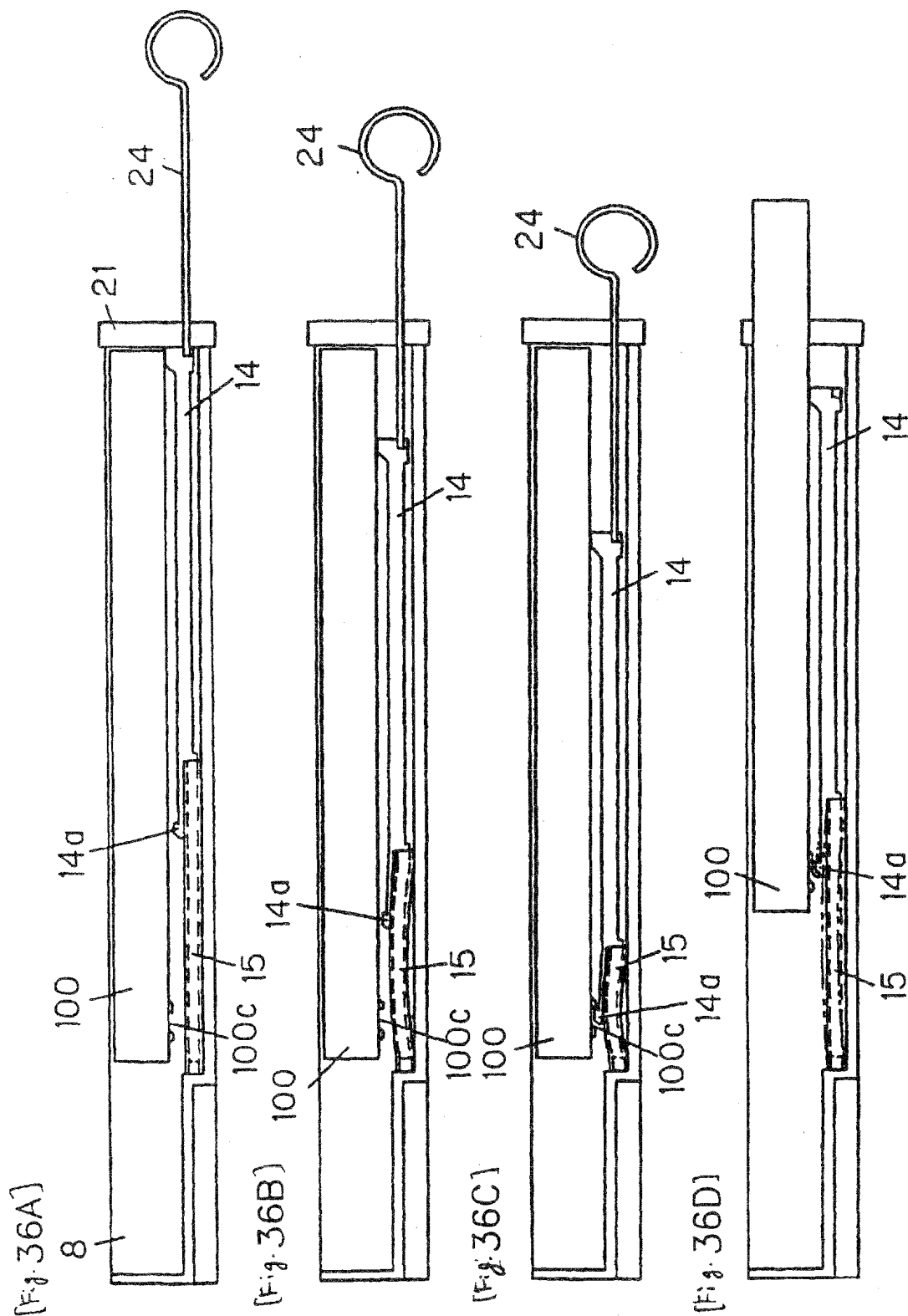
{ Fig. 34A }

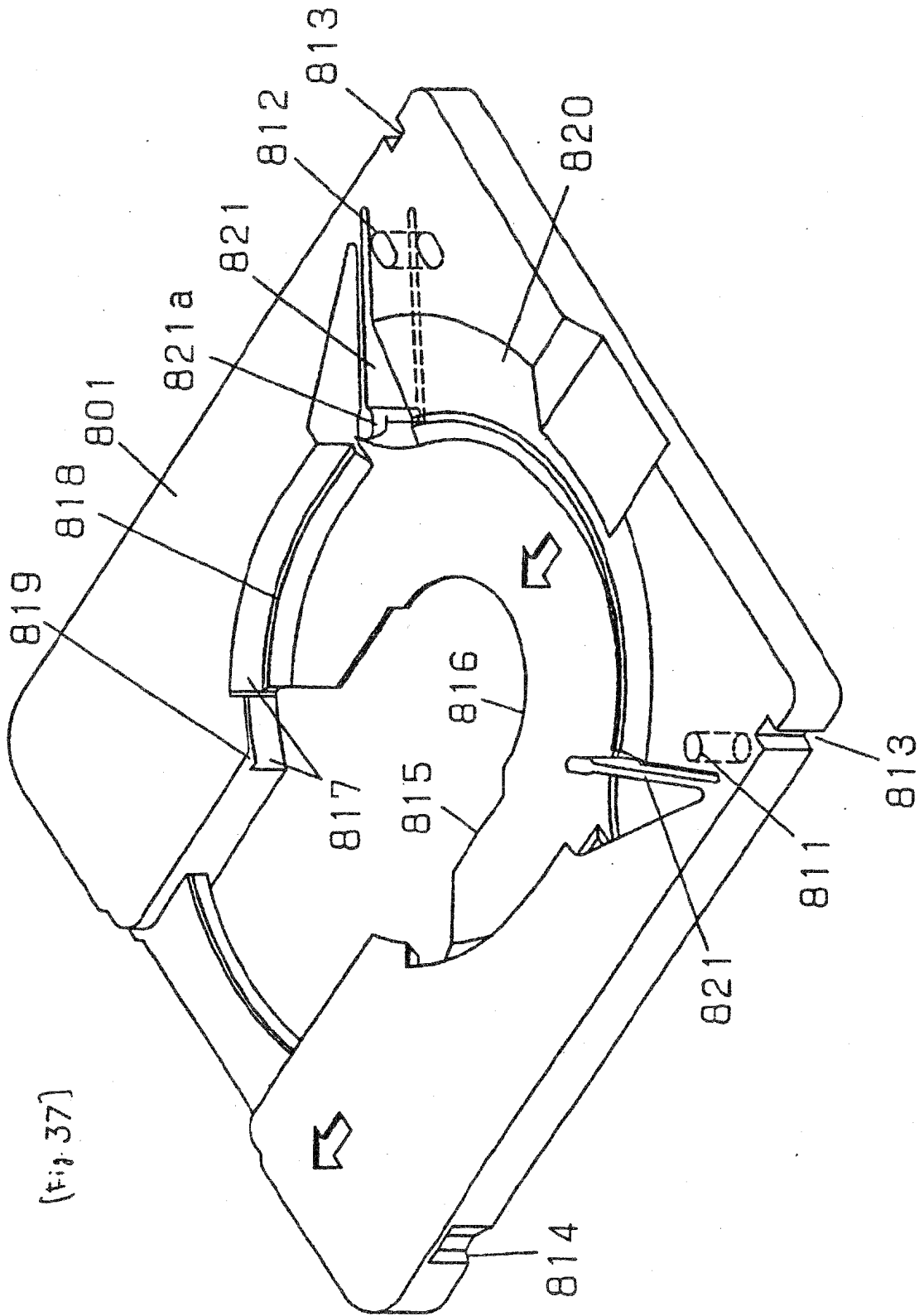


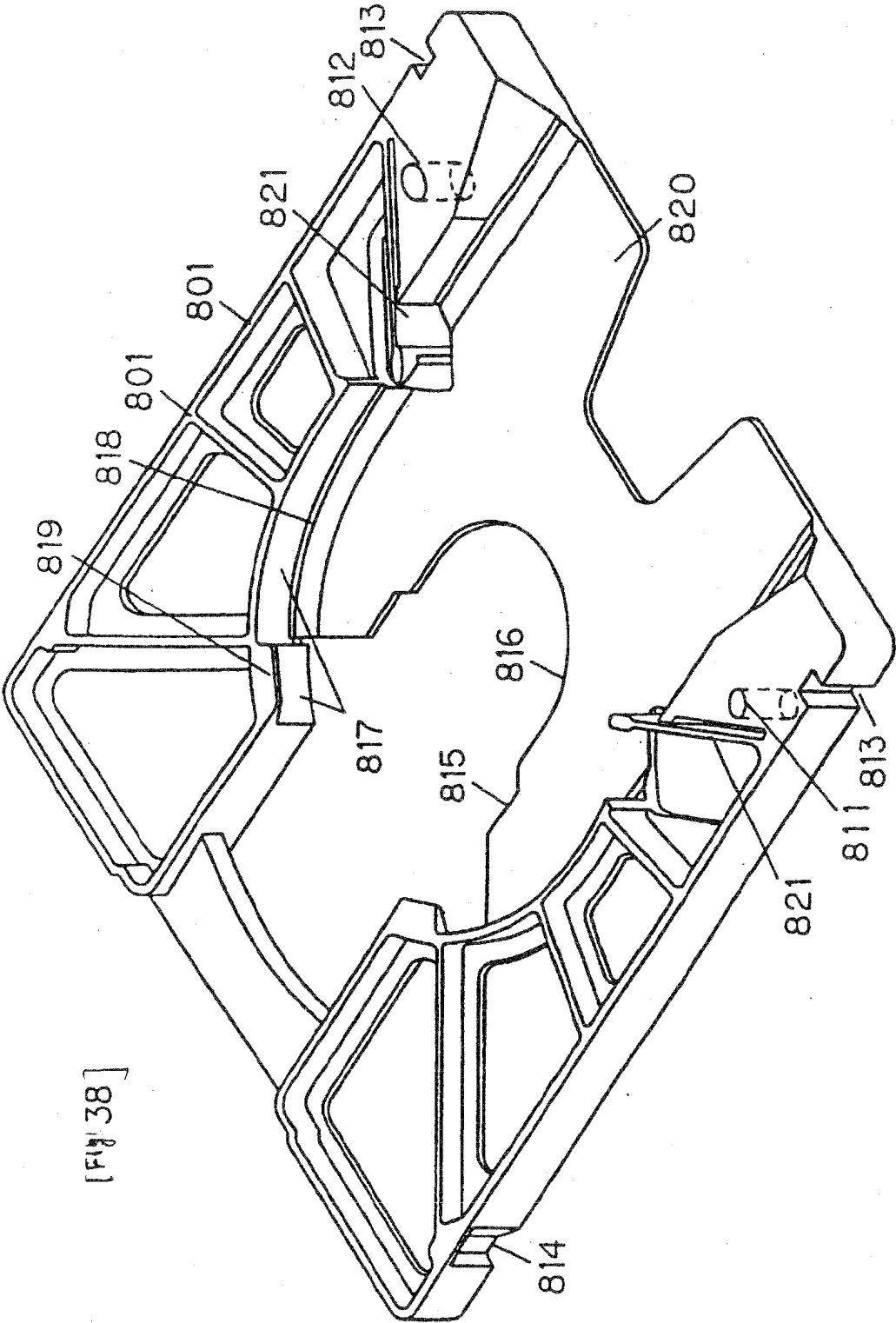
{ Fig. 34B }



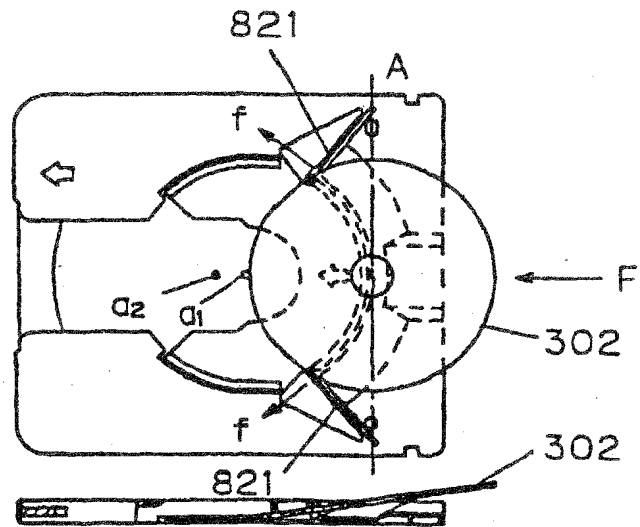




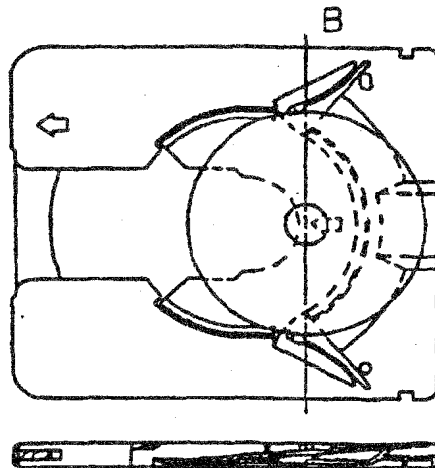




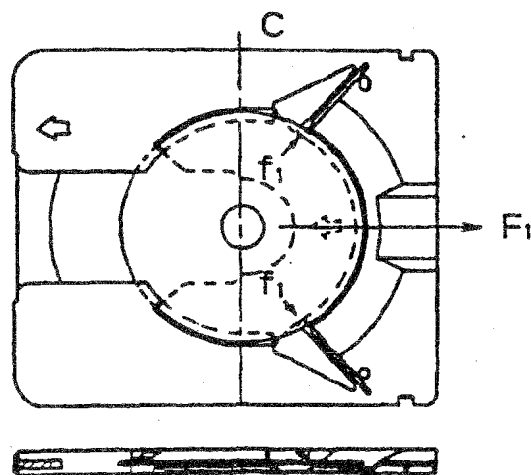
[Fig. 39A]

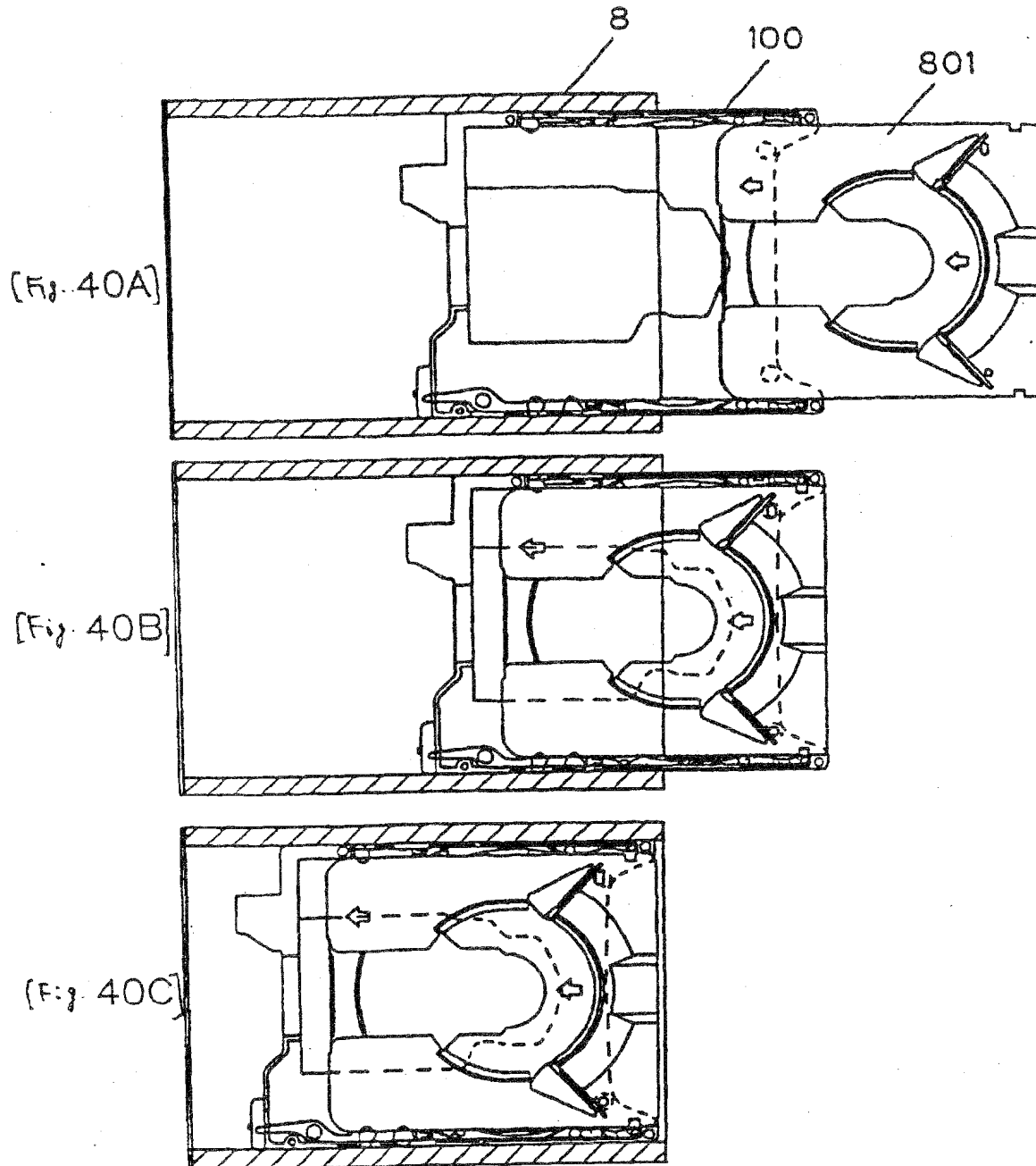


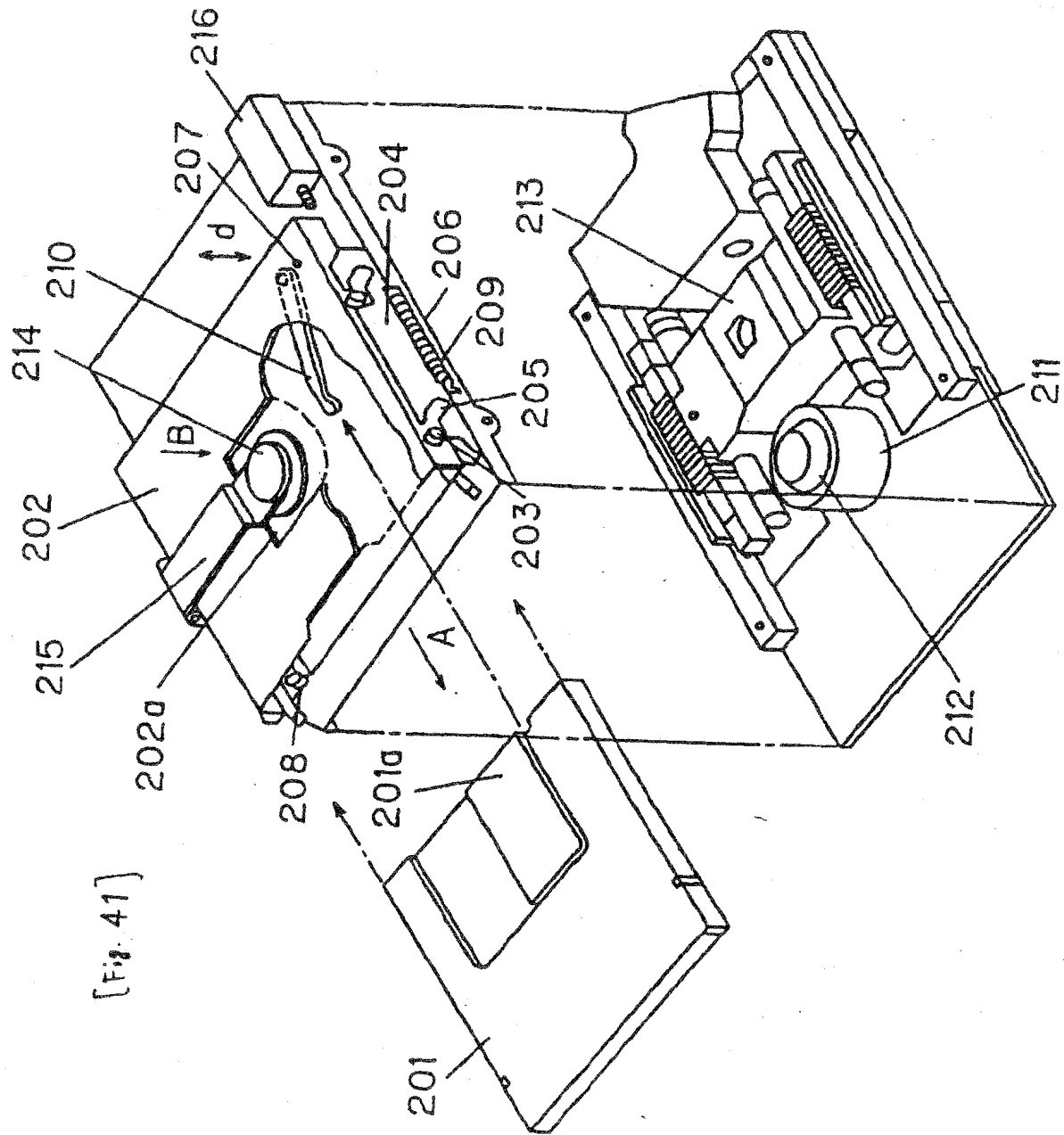
[Fig. 39B]

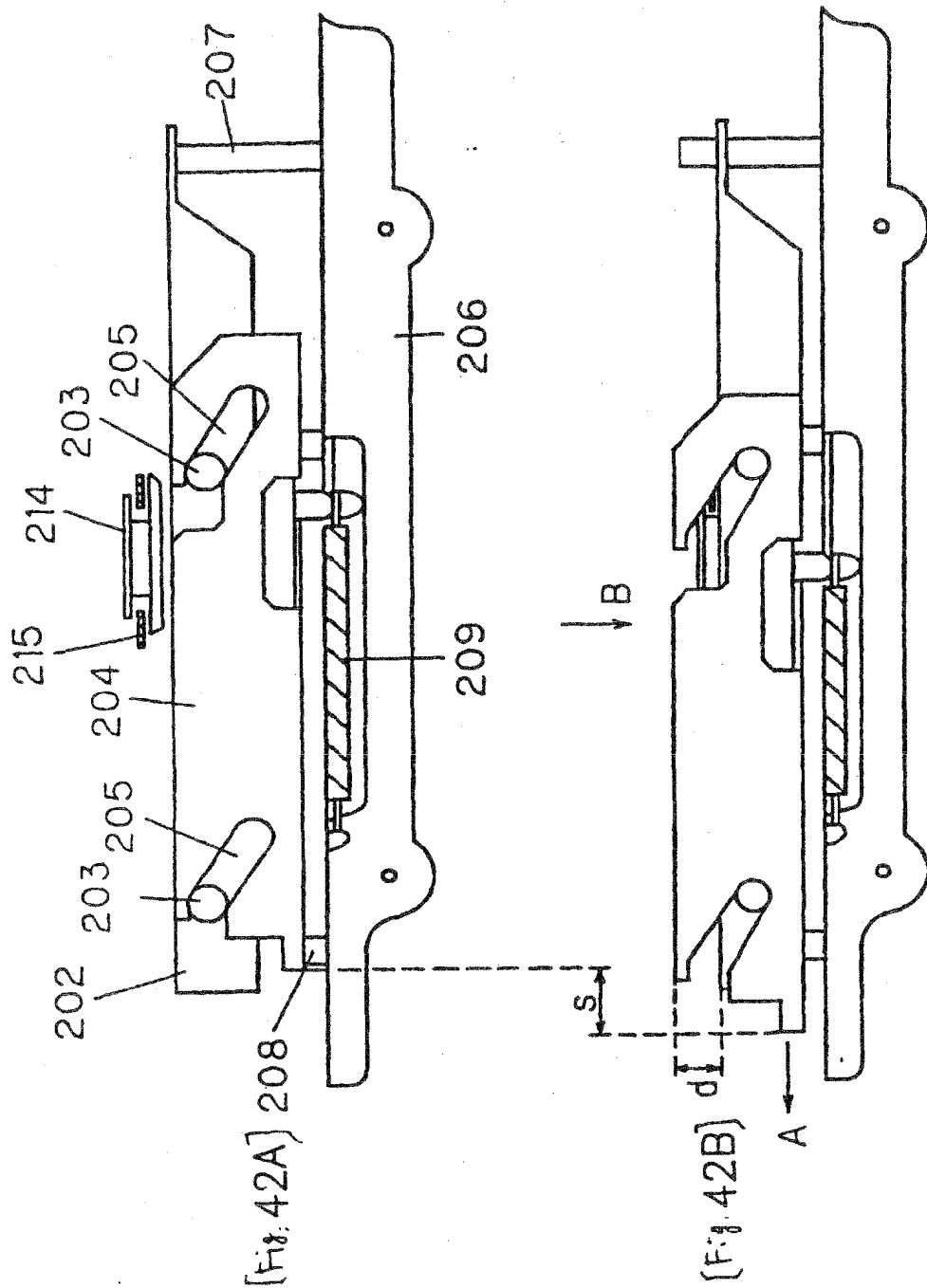


[Fig. 39C]

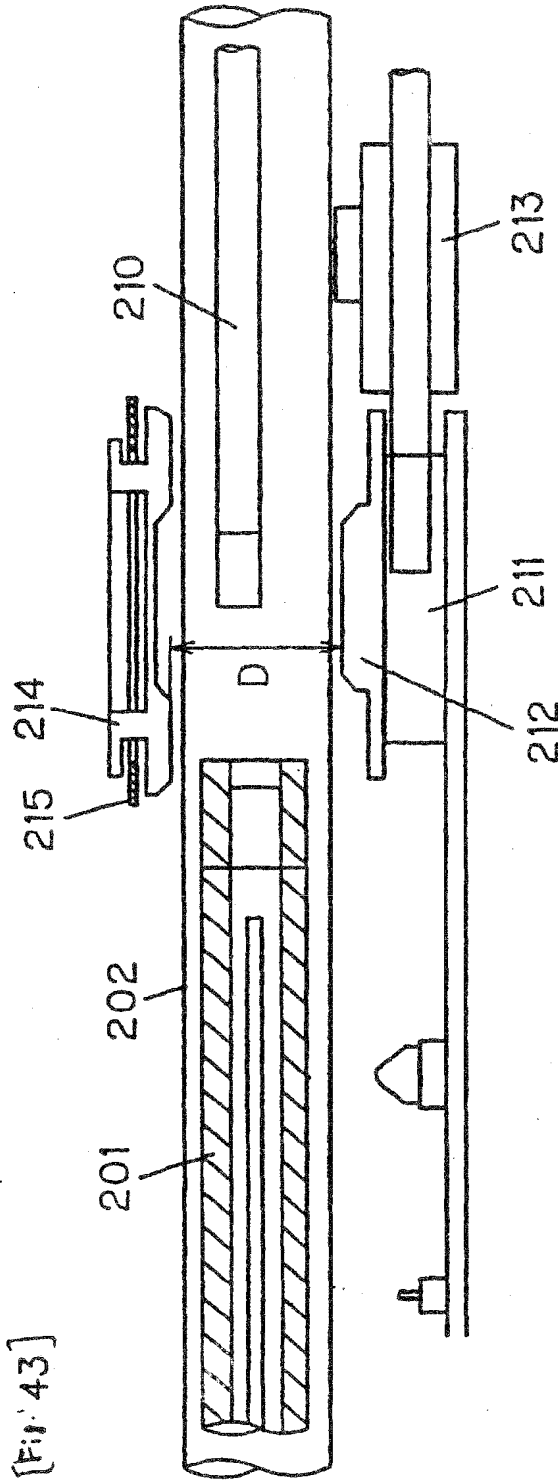


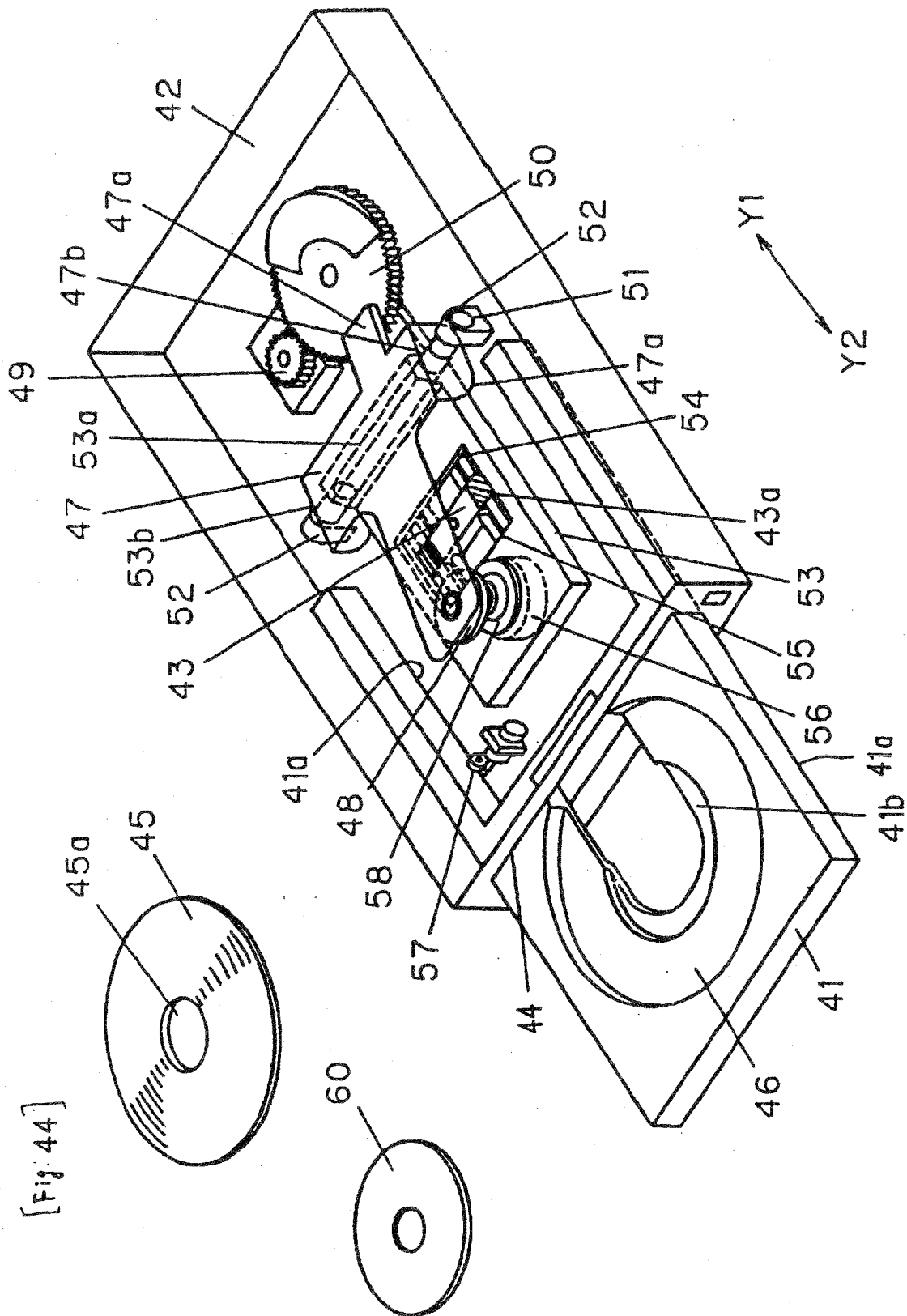


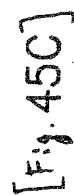
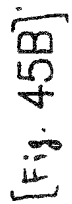
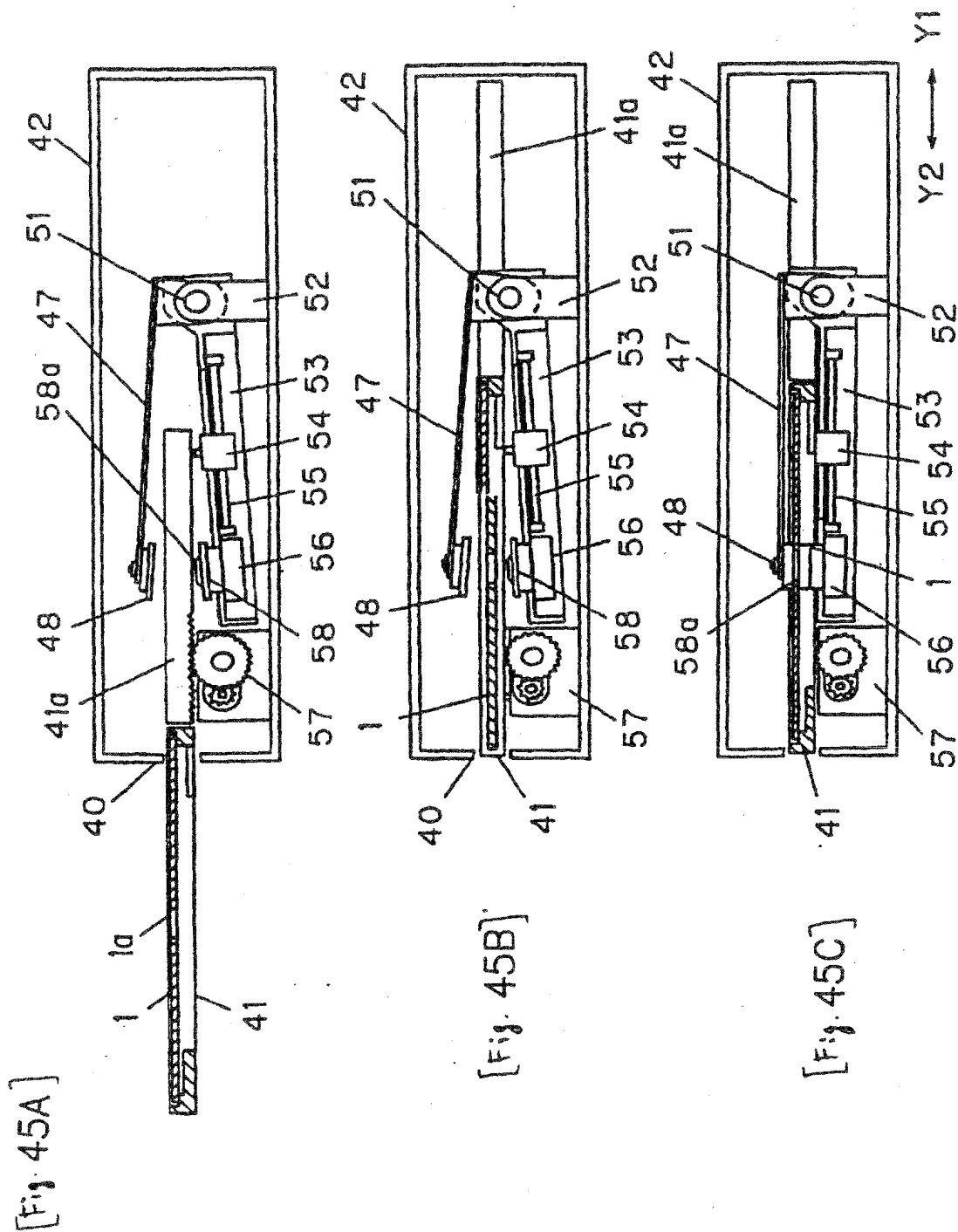




[Fig. 43]







INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP98/02005

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁶ G11B17/04, 23/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁶ G11B17/04, 23/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1971-1998 Toroku Jitsuyo Shinan Koho 1994-1998 Kokai Jitsuyo Shinan Koho 1971-1998		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP, 6-325457, A (Chinon Industries Inc.), 25 November, 1994 (25. 11. 94) (Family: none)	1, 2, 4 3
A	JP, 8-147841, A (Matsushita Electric Industrial Co., Ltd.), 7 June, 1996 (07. 06. 96) (Family: none)	5-7
A	JP, 8-335352, A (Matsushita Electric Industrial Co., Ltd.), 17 December, 1996 (17. 12. 96) (Family: none)	8
X A	JP, 4-61061, A (Canon Inc.), 27 February, 1992 (27. 02. 92) (Family: none)	9 10-12
A	JP, 3-250447, A (Fuji Electric Co., Ltd.), 8 November, 1991 (08. 11. 91) (Family: none)	13
A	JP, 7-161112, A (Matsushita Electric Industrial Co., Ltd.), 23 June, 1995 (23. 06. 95) & EP, 645768, A2 (29. 03. 95)	14
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 3 September, 1998 (03. 09. 98)		Date of mailing of the international search report 16 September, 1998 (16. 09. 98)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No:

PCT/JP98/02005

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

As there is no matter common among the group of inventions of claims 1-4 and 14, that of claims 5-7, the invention of claim 8, the group of inventions of claims 9-12, and the invention of claim 13, it is not considered that there is a technical relationship involving special technical features stipulated in Rule 13.2 of the Regulations under the PCT among these groups of inventions. Therefore, it is considered that this international application has five groups of inventions.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)